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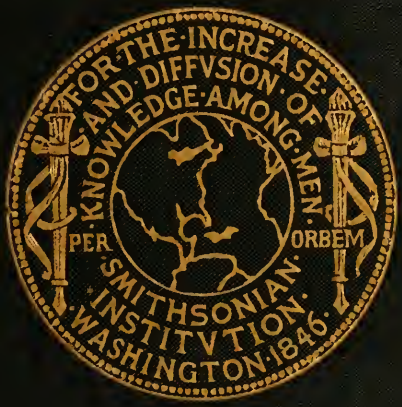

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THE FORAMINIFERA OF THE ATLANTIC OCEAN

PART 7. NONIONIDAE, CAMERINIDAE, PENEROPLIDAE AND ALVEOLINELLIDAE

BY

JOSEPH AUGUSTINE CUSHMAN

Of Sharon, Massachusetts

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INTRODUCTION

This paper is the seventh part of a work the intent of which is to describe and illustrate the Foraminifera of the Atlantic Ocean, especially those species which have occurred in the waters adjacent to the shores of the United States, including the whole of the Gulf of Mexico and the Caribbean Sea, that being the area in which most of the work of the vessels of the United States engaged in dredging work has been done. This part includes the families Nonionidae, Camerinidae, Peneroplidae, and Alveolinellidae. Many of the species of these families live in warm, shallow waters and are not abundant in the deeper waters dredged by the United States Bureau of Fisheries steamer *Albatross*. Some of the Nonionidae, however, are very abundant in these dredgings.

JOSEPH AUGUSTINE CUSHMAN.

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THE FORAMINIFERA OF THE ATLANTIC OCEAN

NONIONIDAE, CAMERINIDAE, PENEROPLIDAE, AND ALVEOLINELLIDAE

By Joseph Augustine Cushman
Of Sharon, Massachusetts

INTRODUCTION

This seventh part of the work on the Atlantic Foraminifera deals with the Nonionidae, Camerinidae, Peneroplidae, and Alveolinellidae. The Nonionidae are represented in the Atlantic by but three genera. These are represented by numerous species, however, often very abundant in dredgings and in shoal-water samples. The Camerinidae are almost wanting in the Atlantic, but are abundant in the Indo-Pacific. The Peneroplidae and Alveolinellidae are represented by simpler, more primitive species in the Atlantic than in the Indo-Pacific, but a few of the species are very abundant in the West Indian region.

Family 24. NONIONIDAE

Test typically planispiral, more or less involute; wall calcareous, finely perforate; aperture simple or cribrate, if simple, at the base of the apertural face.

This family is most abundantly represented in rather shallow water. Of the three most abundant genera, *Elphidium*, *Nonion*, and *Nonionella*, *Elphidium* reaches a great development in warm, shallow waters, especially of the Indo-Pacific where the largest species are found. It is also very abundant along the shores of cold regions, but the species are usually much smaller. *Nonion* and *Nonionella* are more abundant in a little deeper water as a rule, but the various species are well adapted to geographic ranges as are those of *Elphidium*.

The Palaeozoic genera, *Cribrospira* and *Bradyina*, may not belong in this family, although they have much in common with the other members. *Orbignyna* is limited so far as is known to the Cretaceous. *Polystomellina* and *Faujasina* show peculiar modifications, a trochoid form taking the place of the planispiral in the adult.

The structure in most of the genera is fairly simple, but in the larger species of *Elphidium* it becomes complex.

Genus NONION Montfort, 1808

Nonion Montfort, Conch. Syst., vol. 1, 1808, p. 211.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 204.
Melonis Montfort, Conch. Syst., vol. 1, 1808, p. 67 (genoholotype, *Nautilus pompilioides* Fichtel and Moll).
Florilus Montfort, Conch. Syst., vol. 1, 1808, p. 135 (genoholotype, *Nautilus asterizans* Fichtel and Moll).
Pulvinulus (part) Lamarck, 1816.
Placentula (part) Lamarck, 1822.
Cristellaria (part) Lamarck, 1822.
Lenticulina (part) Defrance, 1824 (not Lamarck).
Polystomella (part) Defrance and Authors (not Lamarck).
Nonionina d'Orbigny, Ann. Sci. Nat., vol. 7, 1826 (genotype, by designation, *Nonionina umbilicata* d'Orbigny).

Genoholotype.—Nautilus incrassatus Fichtel and Moll.

Test free, planispiral, more or less involute, bilaterally symmetrical, periphery broadly rounded to acute; chambers numerous; wall finely perforate; aperture, an arched, usually narrow opening between the base of the apertural face and the preceding coil.

Carboniferous (?) to Recent.

Most of the species of *Nonion* are simple in their structure, without a canal system, usually with little ornamentation and not reaching any great size. The passage to *Elphidium* is a gradual one and there are some species of the latter which do not develop the retral processes until toward the end of the growth of the test and which in their early stages would be classed as *Nonion*. This seems to be the most primitive genus of the group.

NONION (?) UMBILICATULUM (Walker and Jacob)

Plate 1, figures 1 *a–b*

"Nautilus spiralis umbilicatus sulcatis" Walker and Boys, Test. Min., 1784, pl. 3, fig. 69.
Nautilus umbilicatulus Walker and Jacob, Adams's Essays, Kannmacher's ed., 1798, p. 641, pl. 14, fig. 34.

A reproduction of the original figure is given here. There is much uncertainty regarding this species. As will be seen by the figures, the two sides are evidently not the same. Parker and Jones commented on this figure as follows: "Figure 69 is a common form of *Truncatulina lobatula*, having the outline of the cells uniform or flush; the septal lines being merely 'furrowed.' According to Walker, it was from Sandwich—not common."

"Montagu, (Test. Brit. Suppl. p. 78), refers to this figure when describing a little *Nonionina;* and Williamson (Monogr. p. 42), makes it a *Polystomella*. We believe that they must both be wrong, because in the specimen figured by Walker the two faces are decidedly unsymmetrical."

If the Boys specimens are preserved, it would be a simple matter to straighten out this tangle, but until such time as this is done there is much uncertainty as to the species. In this connection it is enlightening to note Montagu's comments on the Walker and Jacob figures (copied from Boys), as he had at that time both the original specimens and drawings. "Indeed we perceive so considerable a difference between the original drawings * * * and the engravings taken from them that we would scarce have known them to be the same, had they not been marked with the same numbers."

NONION (?) CRASSULUM (Walker and Jacob)

Plate 1, figures 2 *a–b*

"Nautilus spiralis crassus utrinque umbilicatus geniculis lineatis" WALKER and BOYS, Test. Min., 1784, pl. 3. fig. 70.

Nautilus crassulus WALKER and JACOB, in Adams's Essays, Kannmacher's ed., 1798, p. 641, pl. 14, fig. 35.

This species described from Reculver on the north coast of Kent, England, has been little referred to and the original figure leaves much to be desired. If the types are extant, it may be possible to establish this species on a firm basis. Williamson has referred a form to it which is evidently not at all the same. The original figure is copied here.

NONION DEPRESSULUM (Walker and Jacob)

Plate 1, figures 3–6

"Nautilus spiralis utrinque subumbilicatulus" WALKER and BOYS, Test. Min., 1784, p. 19, pl. 3, fig. 68.

Nautilus depressulus WALKER and JACOB, in Adams's Essays, Kannmacher's ed., 1798, p. 641, pl. 14, fig. 33.

Nonionina depressula HERON-ALLEN and EARLAND, Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 279, pl. 43, figs. 4–7.

There are a great many records given for this species. It was described from Reculver on the north coast of Kent, England. The type figure which is copied here (pl. 8, fig. 3), shows a form with many low, elongate, curved chambers with a small, central, umbilical area. There are very few figures indeed of this species although the number of references is large. Brady's *Challenger* figures do not at all fit this form, but seem nearer to *N. umbilicatulum.* Of the figures given, those of Heron-Allen and Earland quoted above and copied here, (pl. 8, fig. 4) seem to come the nearest to the originals, but these have fewer and broader chambers. Such forms are certainly abundant about the British Isles and the adjacent coast of Europe, and it seems that the name should be restricted to this form. The periphery is rounded, the sides slightly concave, sutures slightly limbate and

much curved, chambers about 10 in number which is several fewer than in the type figure.

NONION POMPILIOIDES (Fichtel and Moll)

Plate 1, figures 7–11; Plate 2, figures 1–2

"Nautilus Melo" Soldani, Testaceographia, vol. 2, 1798, p. 38, pl. 8, figs. *ZZ, A. B. C.*

Nautilus pompilioides Fichtel and Moll, Test. Micr., 1798, p. 31, pl. 2, figs. *a–c.*

Nonionina pompilioides Parker, Jones, and H. B. Brady, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 246, pl. 12, fig. 158.—Terrigi, Atti Accad. Pont. Nuovi Lincei, vol. 35, 1883, p. 204, pl. 4, fig. 49.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 727, pl. 109, figs. 10, 11.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 25. pl. 17, fig. 2 *a, b.*

Melonis etruscus Montfort, Conch. Syst., 1808, p. 67, XVII[e] genre.

Polystomella etrusca Defrance, Dict. Sci. Nat., vol. 32, 1824, p. 183.

Nonionina umbilicatula d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 293, pl.15, figs. 10–12, Modèles No. 86.

Nonionina melo d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 293.

Test planispiral, bilaterally symmetrical, entirely involute, except that the umbilici are deeply excavated, periphery very broadly rounded, entire; chambers 8 to 10 in the last-formed coil, of the same general shape, not inflated; sutures flush with the surface, generally limbate, fusing along the umbilicus to form a slight thickening about it but not raised above the surface; wall smooth, coarsely perforate; aperture slit-like between the base of the apertural face and the previous coil, apertural face broad and low.

This species described by Fichtel and Moll from Recent specimens from the Mediterranean and Pliocene ones from Coroncina, Italy, has been widely recorded. It is not common, however, in the Western Atlantic, but does occur typically, especially in the Late Tertiary of Italy. Joseph Wright recorded a specimen from southwest of Ireland, 1,020 fathoms,[1] and Heron-Allen and Earland a single specimen from the Clare Island region of Ireland.[2]

It occurs sparingly in deep water material. Brady records it in the *Challenger* material from seven stations in the North Atlantic ranging from 1,000 to 2,750 fathoms, and one in the South Atlantic 2,200 fathoms.

The species is similar to *N. umbilicatulum* (Walker and Jacob) but is a much broader, more globular form and the umbilicus is not usually so open.

It is probable that *Nonionina soldanii* d'Orbigny from the Vienna Basin Miocene belongs here also.

[1] Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 492.

[2] Idem, vol. 31, pt. 64, 1913, p. 143.

Nonion pompilioides—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
				° ′ ″ ° ′ ″				
20884	U.S.N.M.	1	D2552	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.	Rare.
20885	U.S.N.M.	1	D2714	38 22 00 N.; 70 08 30 W.	1,825	38	br. oz.	Do.
20886	U.S.N.M.	3	D2041	39 22 50 N.; 68 25 00 W.	1,608		glob. oz.	Do.
20887	U.S.N.M.	12	D2041	39 22 50 N.; 68 25 00 W.	1,608	38	glob. oz.	Abundant.
20888	U.S.N.M.	1	D2262	39 54 45 N.; 69 29 45 W.	250	41.6	gn. m. s.	Rare.
20889	U.S.N.M.	1	D2097	37 56 20 N.; 70 57 30 W.	1,917		glob. oz.	Do.
20890	U.S.N.M.	1	D2038	38 30 30 N.; 69 08 25 W.	2,033		glob. oz.	Do.
20891	U.S.N.M.	1	D2570	39 54 00 N.; 67 05 30 W.	1,813	36.8	glob. oz.	Do.
20892	U.S.N.M.	2	D2035	39 26 16 N.; 70 02 37 W.	1,362		glob. oz.	Do.
20893	U.S.N.M.	3	D2573	40 34 18 N.; 66 08 00 W.	1,742	37.3	gy. m. s.	Do.
20894	U.S.N.M.	3	D2535	40 03 30 N.; 67 27 15 W.	1,149	37.8	gy. oz.	Do.
20895	U.S.N.M.	5	D2568	39 15 00 N.; 68 08 00 W.	1,781	36.9	gy. oz.	Few.
20896	U.S.N.M.	4	D2563	39 18 30 N.; 71 23 30 W.	1,422	37.4	gy. oz.	Rare.
20897	U.S.N.M.	1	D2564	39 22 00 N.; 71 23 30 W.	1,390	37.3	gy. oz.	Do.
20898	U.S.N.M.	1	D2105	37 50 00 N.; 73 03 50 W.	1,395	41	glob. oz.	Do.
20899	U.S.N.M.	1	D2097	37 56 20 N.; 70 57 30 W.	1,917		glob. oz.	Do.
20900	U.S.N.M.	9	D2035	39 26 16 N.; 70 02 37 W.	1,362		glob. oz.	Common.
20901	U.S.N.M.	1	D2029	39 42 00 N.; 70 47 00 W.	1,168	38.5	gy. m.	Rare.
20902	U.S.N.M.	2	D2614	34 09 00 N.; 76 02 00 W.	168		gy. s. bk. sp.	Do.
20903	U.S.N.M.	1		Off Fowey Rocks, Fla.	65			Do.
20904	U.S.N.M.	1		Off Govt. Cut, Fla.	100			Do.
20905	U.S.N.M.	2		Off Fowey Rocks, Fla.	55			Do.
20906	U.S.N.M.	2		Off Govt. Cut, Fla.	75			Do.
20907	U.S.N.M.	2		Off Fowey Lt., Fla.	100			Do.
20920	U.S.N.M.	5		Off Ragged Key, Fla.	80			Few.
20921	U.S.N.M.	1		*Goldseeker* 61° 34′ N.; 2° 4′ E.	[1] 293			Rare.
10167	J.A.C.	1		Upper end, Buzzards Bay, Mass.	3		m. s.	Do.

[1] Meters.

NONION SCAPHUM (Fichtel and Moll)

Plate 2, figures 3, 4

Nautilus scapha Fichtel and Moll, Test. Micr., 1798, p. 105, pl. 19, figs. *d–f*.

Nonionina scapha H. B. Brady, Nat. Hist. Trans. Northumberland and Durham, vol. 1, 1865 (1867), p. 106, pl. 12, figs. 10 *a*, *b*.—Terrigi, Atti Accad. Pont. Nouvi Lincei, vol. 35, 1883, p. 202, pl. 4, fig. 47.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 730, pl. 109, figs. 14, 15, 16 (?).—Terrigi, Atti Accad. Lincei, ser. 4, Mem. vol. 6, 1893, p. 120, pl. 10, fig. 7.—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 104, pl. 17, fig. 830 (part) (?).—Cushman, Publ. 342, Carnegie Instit., Washington, 1924, p. 47, pl. 16, fig. 1.

Nonionina communis d'Orbigny, Foram. Foss. Bass. Tert. Vienne, 1846, p. 106, pl. 5, figs. 7, 8.—Parker and Jones, Ann. Mag. Nat. Hist., ser. 2, vol. 19, 1857, p. 287, pl. 11, figs. 7, 8.—Terquem, Essai Class. Anim. Dunkerque, 1875, p. 24, pl. 1, figs. 17 *a*, *b*.—Terrigi, Atti Accad. Pont. Nuovi Lincei, vol. 33, 1880, p. 96, pl. 4, figs. 75, 76.

Nautilus faba Fichtel and Moll, Test. Micr., 1798, p. 103, pl. 19, figs. *a–c*.

Test planispiral, bilaterally symmetrical, somewhat evolute, periphery rounded, whole test compressed, umbilici depressed, unornamented; chambers numerous averaging about 12 in the last-formed coil, later ones as they tend to become evolute, broadening on the proximal end and the outline of the periphery somewhat less curved and the chambers slightly more inflated; sutures distinct,

depressed, not limbate; wall smooth, finely perforate; aperture, a small opening at the base of the apertural face next to the preceding coil.

Both *Nautilus scapha* and *N. faba* of Fichtel and Moll seem to represent the same species, and d'Orbigny's *Nonionina communis* from the Vienna Basin is apparently the same from material examined.

There are a great many records for *Nonion scapha* in the literature, but as very few of them are accompanied by illustrations, they can not be definitely placed here until the material representing them can be examined and checked.

As already noted, there is a tendency toward *N. asterizans* especially in the Italian region.

NONION ASTERIZANS (Fichtel and Moll)

Plate 2, figures 5–7

Nautilus asterizans Fichtel and Moll, Test. Micr., 1798, p. 37, pl. 3, figs. *e–h*.

Nonionina asterizans Terrigi, Atti Accad. Pont. Nuovi Lincei, vol. 33, 1880, p. 95, pl. 4, fig. 78.

Nonionina boueana d'Orbigny, Foram. Foss. Bass. Tert. Vienne, 1846, p. 108, pl. 5, figs. 11, 12.—Reuss, Bull. Acad. Roy. Sci. Belg., ser. 2, vol. 15, 1863, p. 156, pl. 3, figs. 47, 48.—Terrigi, Mem. Com. Geol. Ital., vol. 4, pt. 1, 1891, p. 110, pl. 4, fig. 17; Atti Accad. Lincei, ser. 4, Mem., vol. 6, 1893, p. 119, pl. 10, fig. 5.—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 104, pl. 17, fig. 829.—Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 5, vol. 8, 1900, p. 46, fig. 49 (in text).

Nonionina communis Terrigi (not d'Orbigny), Atti Accad. Pont. Nuovi Lincei, vol. 35, 1883, p. 205, pl. 4, fig. 51.

Test planispiral, bilaterally symmetrical, completely involute or very slightly evolute, periphery angular, umbilici depressed, often with a few very small beads; chambers numerous, usually about 12 in the last-formed coil, broad and low, of uniform shape throughout; sutures distinct, depressed, usually somewhat limbate, the broadest part toward the inner end thence thinning toward the periphery, evenly curved; wall smooth, except for the umbilical region which occasionally has a few small beads, finely perforate; apertural face convex, in peripheral view with the sides convex, aperture itself at the base of the face next to the previous coil, short and narrow or sometimes rounded.

The originals of Fichtel and Moll came from the Mediterranean. The species is common in the Pliocene of Italy and in the Pliocene and Miocene of many parts of Europe. Many species have been placed under this name that obviously do not belong here. d'Orbigny's *Nonionina boueana* from the Vienna Basin Miocene does not differ essentially from Fichtel and Moll's species. In fact, the figure given by Fornasini from the "planches inédites" has the umbilical region slightly beaded.

There seems to be no authentic record of the species from the Western Atlantic and it apparently has a Mediterranean and Indo-Pacific distribution at the present time. A few specimens are referred to *N. boueana* from the Coast of England by Heron-Allen and Earland. Goës records it in his paper from 48° N. latitude and 10° W. longitude.

Nonion scaphum (Fichtel and Moll) is very close to this species, and in the Pliocene of Italy the two seem to merge one into the other. "*Nautilus faba*" Fichtel and Moll is also close to this species. It is also from Rimini on the Adriatic and from the Pliocene of the Siena region.

NONION STELLIGERUM (d'Orbigny)

Plate 2, figures 8–12; Plate 3, figures 1–3

Nonionina stelligera d'Orbigny, in Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, vol. 2, pt. 2, 1839, "Foraminifères," p. 128, pl. 3, figs. 1, 2 (*N. stellifera* on plate).—H. B. Brady, Trans. Linn. Soc. Zool., vol. 24, 1864, p. 471, pl. 48, fig. 19; Ann. Mag. Nat. Hist., ser. 5, vol. 8, 1881, p. 414; Denkschr. Kais. Akad. Wiss., vol. 43, 1881, p. 17; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 728, pl. 109, figs. 3, 4, (not 5).—Balkwill and Wright, Trans. Roy. Irish Acad., vol. 28, Sci., 1885, p. 353.—Siddall, Proc. Lit. Philos. Soc. Liverpool, 1886, p. 71 (list).—Halkyard, Trans. Manchester Micr. Soc., 1889, p. 71.—Chaster, First Rep't Southport Soc. Nat. Sci., 1890–91 (1892), p. 66.—Wright, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 493.—Woodward, The Observer, vol. 4, 1893, p. 201.—(?) Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 104, pl. 17, figs. 827, 828.—Morton, Proc. Portland Soc. Nat. Hist., vol. 2, 1897, p. 121, pl. 1, fig. 18.—Kiaer, Norwegian No. Atl. Exped. Zool., Thalamophora, 1899, p. 7 (table).—Wright, Irish Nat., vol. 9, 1900, p. 55.—Earland, Journ. Quekett Micr. Club, ser. 2, vol. 9, 1905, p. 229.—Kiaer, in Duc d'Orleans. Crois. Ocean. Mer. Grönl., 1905 (1907), p. 562.—Millett, Rec. Foram. Galway, 1908, p. 7.—(?) Sidebottom, Mem. Proc. Manchester Lit. Phil. Soc., vol. 53, No. 21, 1909, p. 13, pl. 4, fig. 9; vol. 54, No. 16, 1910, p. 29.—Wright, Proc. Belfast Nat. Field Club, Appendix, 1910–11, p. 8.—Awerinzew, Mém. Acad. Imp. Sci., St. Pétersburg, ser. 8, vol. 29, No. 3, 1911, p. 25.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 144.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 27, pl. 14, fig. 4; pl. 15, fig. 4; pl. 16, fig. 2.—Heron-Allen and Earland, Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 280, pl. 43, figs. 8–10.—Cushman, Rep't Canadian Arctic Exped., pt. M, 1920, p. 10; Contrib. Canadian Biol., 1921 (1922), p. 13.

Test planispiral, completely involute, compressed, periphery rounded, composed of about 10 chambers in the last-formed coil; chambers distinct, slightly inflated, broader than high; sutures distinct, toward the umbilical end with a secondary filling, making a stellate ornamentation in the umbilical areas; wall smooth, very finely perforate; aperture, a narrow opening at the base of the apertural face, next to the preceding coil.

Length, 0.40 mm.; breadth, 0.08 mm.

D'Orbigny described this species from the Canaries. It is widely distributed in cold waters. Some of the Atlantic records are as follows: Shetland Islands (80 fathoms, very rare); off Nova Zembla, Franz-Joseph Land and Spitzbergen, Smith Sound, as far north as latitude 82° 33′ N.; off the British Isles, 64–155 fathoms and sparingly on the British and French coasts (Brady); off coast of Dublin (Balkwill and Wright); Liverpool Bay (Siddall); Jersey (Halkyard); off Southport, England (Chaster); off Southwest Ireland and shore sands of Dogs Bay, Ireland (Wright); Harlem River, N. Y. (Wòodward); Spitzbergen and coast of Norway (Goës); Bognor, Sussex, England (Earland); Norway and between Norway and Greenland (Kiaer); off Galway (Millett); Clare Island region, Ireland and west of Scotland (Heron-Allen and Earland); Hudson Bay (Cushman).

In the Pleistocene of Ireland (Wright), and near Portland, Me. (Morton), it appears. There are other fossil records not so well defined, and a few records for its occurrence in the Mediterranean and the Pacific but specimens are not typical.

There is a Pacific form similar to that figured by Brady (pl. 109, fig. 5), which has fewer, higher and more inflated chambers. The specimens figured by Heron-Allen and Earland from west of Scotland are composed of fewer chambers than in the typical form.

A few of the records of *N. asterizans* (Fichtel and Moll) may be *N. stelligerum*, but the originals must be seen to determine this.

Nonion stelligerum—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
20919	U.S.N.M.	4	D2756	Lat. S. 32° 20′ 00″; 37° 49′ 00″.	417	40.5	gy. sbk. sp.	Rare.
20949	U.S.N.M.	1		Off Fowey Strait, Fla	100			Do.
3271	J.A.C.	1	43C	Canadian Arctic Expedition, Dolphin and Union Strait.	[1]20–30			Do.
3272	J.A.C.	1		Hudson Bay, Richmond Gulf, east coast.	15–20			Do.
10192	J.A.C.	10		Coast of Iceland				Abundant.

[1] Meters.

NONION GERMANICUM (Ehrenberg)

Plate 3, figures 4, 5

Nonionina germanica Ehrenberg, Abhandl. k. Akad. Wiss. Berlin, 1839, p. 133, pl. 2, figs. 1 *a–g;* in Taylor's Scientific Mem., vol. 3, 1843, p. 357, pl. 6, figs. 1 *a–g*.

Nonionina crassula Williamson (not Walker and Jacob), Rec. Foram. Gt. Britain, 1858, p. 33, pl. 3, figs. 70, 71.

Test close coiled, completely involute, planispiral, bilaterally symmetrical, periphery rounded; about nine chambers in the last-formed coil, distinct, of uniform size and shape; sutures very slightly if at all depressed, slightly limbate and thickened toward the umbilical

region which is filled; wall smooth, distinctly but finely perforate; aperture, a narrow slit at the base of the apertural face.

Diameter usually less than 0.50 mm.; thickness about 0.18 mm.

This is a very common species in the North Sea and about the British Isles, well figured by Williamson. It is somewhat difficult to place earlier records without figures, but this has probably been recorded from this area. It is very close to the species of *Elphidium* from the same area such as is referred to by Heron-Allen and Earland in their report from the west of Scotland as "*Polystomella faba.*" It is apparently not found on the western side of the Atlantic.

Nonion germanicum—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
10181	J.A.C.	13	----------	Shore sand. Bognor, Sussex, England.	-------	-------	----------	

NONION SLOANII (d'Orbigny)

Plate 3, figures 6–8

Nonionina sloanii D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 68, pl. 6, figs. 18, 18*bis*.—CUSHMAN, Publ. 291, Carnegie Instit., Washington, 1919, p. 48; Publ. 344, 1926, p. 79.

This may be a form of *N. scaphum* (Fichtel and Moll). It differs from *N. grateloupi* in the broader apertural face and the narrower form in front view. d'Orbigny described and figured this species from Jamaica as rare, and mentioned that it was like a similar form occurring fossil at Dax. I had material referred to this species from Late Tertiary marl, from the gorge of the Yumuri River, Matanzas, Cuba and from Bluff 2, Cercado de Mao, Santo Domingo. It also occurred in recent collections from San Juan Harbor, Porto Rico.

It may prove to be only a more inflated, but narrower form of *N. grateloupi* (d'Orbigny).

Very close to this is the species described by d'Orbigny from shore sands of Cuba and Jamaica as *Nonionina brownii*. It is a somewhat inflated form and probably is a synonym of *N. sloanii*.

Nonion sloanii—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
3270	J.A.C.	2	1--------	San Juan Harbor, Porto Rico.	5	-------	----------	Rare.
10301	J.A.C.	1	----------	-----do----------	1 9	-------	----------	Do.
10305	J.A.C.	3	----------	-----do----------	1 15	-------	----------	Do.

NONION GRATELOUPI (d'Orbigny)

Plate 3, figures 9–11; Plate 4, figures 1–4

Nonionina grateloupi D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 294, No. 19; in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 46, pl. 6, figs. 6, 7.—FORNASINI, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 1, 1904, p. 12, pl. 3, fig. 5.—CUSHMAN, Publ. 291, Carnegie Instit. Washington, 1919, p. 48; Proc. U. S. Nat. Mus., vol. 59, 1921, p. 61, pl. 14, figs. 9–11; Publ. 311, Carnegie Instit. Washington, 1922, p. 55, pl. 9, figs. 7, 8; Publ. 344, 1926, p. 79.

Test planispiral, bilaterally symmetrical, mostly involute, in peripheral view the sides nearly parallel, periphery rounded; chambers numerous, usually 10 to 12 in the last-formed coil in adults, chambers increasing rapidly in length, especially in the last few chambers; sutures distinct, slightly depressed; wall smooth, finely perforate; aperture small, at the base of the last-formed chamber, narrow.

Length, up to 0.60 mm.; breadth, 0.35 mm.; thickness, 0.22 mm.

D'Orbigny originally noted this species from the Miocene of Dax, France. Later he described and figured a species under the same name from shore sands of Cuba, Jamaica and Martinique. I have recorded it from Montego Bay, on the north coast of Jamaica, from numerous stations about the Tortugas, and from San Juan Harbor, Porto Rico. It occurred fossil in the Late Tertiary of the gorge of the Yumuri River, Matanzas, Cuba, and from Bluff 3, Cercado de Mao, Santo Domingo. It is the most common species of the genus in the West Indian region.

Nonion grateloupi—Material examined

Cat. No	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
						° C.		
3228	J.A.C.	2	22	Dry Tortugas, Fla	6		fne. s	Rare.
3233	J.A.C.	15	14	do	12		do	Abundant.
3234	J.A.C.	2	13	do	11		do	Rare.
3235	J.A.C.	5	12	do	7	23	s	Few.
3236	J.A.C.	3	10	do	11	23.2	s	Rare.
3237	J.A.C.	13	19	do	5.34		fne. s	Abundant.
3238	J.A.C.	19	18	do	7		do	Do.
3239	J.A.C.	9	21	do	6		do	Do.
3240	J.A.C.	3	23	do	10.5		m. s	Rare.
3241	J.A.C.	14	20	do	7		fne. s	Abundant.
3242	J.A.C.	8	22	do	6		do	Common.
3243	J.A.C.	1	4	Porto Rico	1			Rare.
3244	J.A.C.	1	5	do	3.3			Do.
3245	J.A.C.	2		Montego Bay, Jamaica	10			Do.
10306	J.A.C.	3		San Juan Harbor, Porto Rico	[1]15			Do.
10300	J.A.C.	1		do	[1]9			Do.
10189	J.A.C.	6	23	Dry Tortugas, Fla	10.5		m. s	Few.
20883	U.S.N.M.	2	(Albatross)	Off Ragged Key, Fla	80			Rare.
				° ′ ″ ° ′ ″				
20882	U.S.N.M.	1	D2150	13 34 45 N.; 81 21 10 W	382	45.75	wh. cr. s	Do.
20881	U.S.N.M.	3	D2758	6 59 30 S.; 34 47 00 W	20	79	brk. sh	Do.
3229	J.A.C.	11	27	Dry Tortugas, Fla	7		m. fne. s	Abundant.
3230	J.A.C.	4	42	do	18		s	Rare.
3231	J.A.C.	4	37	do	11		fne. s	Do.
3232	J.A.C.	14	28	do	4.75		do	Abundant.

[1] Feet.

NONION BARLEEANUM (Williamson)

Plate 4, figure 5

Nonionina barleeana WILLIAMSON, Rec. Foram. Gt. Britain, 1858, p. 32, pl. 3, figs. 68, 69.

Test planispiral, bilaterally symmetrical, much compressed; periphery rounded, umbilici depressed and open; chambers numerous, 12 or more in the last-formed coil, of rather uniform shape and size; sutures curved, slightly limbate, not depressed; wall smooth, coarsely perforate; aperture semicircular, at the base of the apertural face.

Diameter slightly less than 0.65 mm.; thickness, 0.18 mm.

Williamson's specimens were from Skye, Stornoway, Shetlands, and Scarborough. Such forms have been recorded from about the British Isles as *Nonionina umbilicatula*. With the great uncertainty existing in regard to the latter species, it seems best to use Williamson's name for this cold-water species.

NONION LABRADORICUM (Dawson)

Plate 4, figures 6–12

Nonionina labradorica DAWSON, Can. Nat., vol. 5, 1860, p. 191, fig. 4.—JONES, PARKER, and H. B. BRADY, Crag Foram., Pal. Soc., vol. 19, 1866, pl. 2, figs. 44, 45.

Nonionina scapha (FICHTEL and MOLL), var. *labradorica* DAWSON, Can. Nat., vol. 5, 1870, p. 177, fig. 5; Amer. Journ. Sci., ser. 3, vol. 1, 1871, p. 206, fig. 5; Ann. Mag. Nat. Hist., ser. 4, vol. 7, 1871, p. 86, fig. 5; Can. Nat., vol. 6, 1872, p. 255, pl. 3, fig. 4.

Nonion labradorica CUSHMAN, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 148, pl. 2, figs. 7, 8.

Nonionina scapha MORTON (not Fichtel and Moll), Proc. Portland Soc. Nat. Hist., vol. 2, 1897, p. 121, pl. 1, figs. 23 *a*, *b*.

Test small, planispiral, completely involute, bilaterally symmetrical, periphery bluntly angled, apertural face very broadly triangular, the sides convex; chambers few, rapidly increasing in size as added; sutures distinct, curved, very slightly if at all depressed, not limbate; wall thin, finely perforate; aperture, a narrow slit at the base of the apertural face.

Length, 0.50 mm.; breadth, 0.30 mm.; thickness, 0.30 mm.

This is an abundant species in the cold waters from northern New England northward, and occurs also off the western coast of America. Dawson's specimens were from the Gulf of St. Lawrence.

The apertural face is very broadly triangular.

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Nonion labradoricum—*Material examined*

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
				° ′ ″ ° ′ ″				
20913	U.S.N.M.	1	D2573	40 34 18 N.; 66 09 00 W.	1,769	37.8	gy. oz	Rare.
20914	U.S.N.M.	1	D2084	40 16 50 N.; 67 05 15 W.	1,290	40	bu. m. & s.	Do.
20915	U.S.N.M.	9	D2078	41 11 30 N.; 66 12 20 W.	499	40	gy. m. & s.	Common.
20916	U.S.N.M.	1	D2748	39 31 00 N.; 71 14 30 W.	1,163	37.8	gy. m. fur.	Rare.
20917	U.S.N.M.	3	D2202	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m	Do.
20918	U.S.N.M.	15	D2581	39 43 00 N., 71 34 00 W.	394	------	do	Abundant.
20922	U.S.N.M.	2	D2202	39 38 00 N.; 71 39 45 W.	515	39.1	do	Rare.
10320	J.A.C.	3	D2078	40 16 50 N.; 67 05 15 W.	1,290	40	bu. m. & s.	Do.
10151	J.A.C.	17	------	Casco Bay, North; off Harpswell, Me.	------	------	------	Abundant.
3259	J.A.C.	2	------	Gaspé Bay	30-40	------	------	Rare.
3260	J.A.C.	1	------	Hudson Bay, Lat. 55° N. South of Black Whale Harbor.	10	------	------	Do.
3261	J.A.C.	2	------	do	10	------	------	Do.

NONION ORBICULARE (H. B. Brady)

Plate 5, figures 1–3

Nonionina orbicularis H. B. Brady, Ann. Mag. Nat. Hist., ser. 5, vol. 8, 1881, p. 415, pl. 21, figs. 5 *a*, *b*; Denkschr. Kais. Akad. Wiss. Math-Nat. Cl., vol. 43, 1881, p. 17, pl. 2, figs. 5 *a*, *b*; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 727, pl. 109, figs. 20, 21.—Heron-Allen and Earland, Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 280.—Cushman, Contr. Canadian Biol., 1921 (1922), p. 13.

Test planispiral, bilaterally symmetrical, completely involute, periphery very broadly rounded; chambers 10 to 12 in the last-formed coil, distinct, not inflated, of uniform shape; sutures distinct, slightly depressed, slightly limbate toward the proximal end; wall very finely perforate, smooth; aperture, a long, very narrow slit at the base of the apertural face, sometimes divided into several openings.

Diameter, 0.75 mm.; thickness, 0.50 mm.

This species described from the Arctic off Nova Zembla has occurred typically in Hudson Bay, and is recorded by Heron-Allen and Earland off the west coast of Scotland. Brady in the *Challenger* Report gives the following localities: West coast of Nova Zembla, 55 fathoms; shores of Spitzbergen, 7 fathoms; Faroe Channel, 632 fathoms; west coast of Scotland, 25 fathoms, and off Valentia, 112 fathoms. He also records it fossil from a Post-Tertiary clay on the coast of Fifeshire.

The forms recorded from warm waters and referred to this species are not the same.

Nonion orbiculare—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
3255	J.A.C.	2	----------	Hudson Bay, south of Black Whale Harbor, lat. 55° N.	10	-------	----------	Rare.
3256	J.A.C.	9	----------	-----do----------	10	-------	----------	Common.
3527	J.A.C.	1	----------	-----do----------	10	-------	----------	Rare.
3258	J.A.C.	1	----------	Hudson Bay, James Bay	10	-------	----------	Do.

NONION PAUPERATUM (Balkwill and Wright)

Plate 5, figures 4, 5, 7

Nonionina pauperata Balkwill and Wright, Trans. Roy. Irish Acad., vol. 28, Sci., 1885, p. 353, pl. 13, figs. 25, 26.—Halkyard, Trans. Manchester Micr. Soc., 1889, p. 71, pl. 2, fig. 13.—Chaster, First Rep't Southport Soc. Nat. Sci., 1890–91 (1892), p. 66.—Wright, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 493; Irish Nat., vol. 9, 1900, p. 55.—Earland, Journ. Quekett Micr. Club, ser. 2, vol. 9, 1905, p. 230.—Millett, Rec. Foram. Galway, 1908, p. 7.—Wright, Proc. Belfast Nat. Field Club, Appendix, 1910–11, p. 7.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1911, p. 342, pl. 11, figs. 16, 17; Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 144; Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 281.

Test planispiral, bilaterally symmetrical, involute, periphery angular; chambers, about nine in the last-formed coil, of uniform shape and relative size, slightly inflated; sutures distinct, slightly depressed, limbate toward the proximal end, the umbilicus filled and confluent with the sutures; wall distinctly perforate, smooth; aperture, a low opening at the base of the apertural face.

There are numerous records for this species about the British Isles, the following among them: Off Dublin coast (Balkwill and Wright); off Jersey (Halkyard); off Southport, England, rare in shore gatherings and shallow water (Chaster); southwest of Ireland, 53 and 345 fathoms; Dogs Bay, very rare (Wright); Bognor, Sussex, rare (Earland); Galway, very rare (Millett); Selsey Bill, Sussex; Clare Island region of Ireland; west of Scotland (Heron-Allen and Earland). Wright also records it from the Pleistocene of the north of Ireland.

This is very much like *N. germanicum* and may be only a slightly broader form of the same species.

NONION (?) EXPONENS (H. B. Brady, Parker, and Jones)

Plate 5, figure 6

Nonionina exponens H. B. Brady, Parker, and Jones, Trans. Zool. Soc., vol. 12, 1888, p. 230, pl. 43, fig. 16.

"Test free, equilateral, planospiral; lateral faces convex or somewhat flattened, peripheral edge rounded; composed of from 2 to 3

convolutions; all more or less visible on both sides of the shell, the final whorl consisting of about 7 or 8 segments; margin entire; septa marked by fine lines, without superficial depressions. Diam. 1/100th inch (0.25 mm.)."

"A form somewhat allied to *N. depressula* but differing from that species in its evolute mode of growth, its even sutures and noninflated segments."

This species was described and figured by the authors from 940 fathoms off the Abrohlos Bank off Brazil. Its position as a *Nonion* seems doubtful, but it is included here for the record.

There are several names given by Ehrenberg which it is difficult to identify and which with our present knowledge can not be definitely placed.

"*Nonionina Aglajae*" Ehrenberg, Abhandl. Akad. Wiss. (Berlin), 1872 (1873), pl. 4, fig. 3, from bottom sample from Atlantic Telegraph line, 9,600 feet in depth.

"*Nonionina Crisiae*" Ehrenberg, Abhandl. Akad. Wiss. (Berlin), 1872 (1873), pl. 3, fig. 8, from 11,580 feet in depth.

"*Nonionina hyalina*" Ehrenberg, Abhandl. Akad. Wiss. (Berlin), 1872 (1873), pl. 4, fig. 4, from 9,540 feet in depth.

"*Nonionina borelis*" Ehernberg, Abhandl. Akad. Wiss. (Berlin), 1872 (1873), pl. 1, fig. 18, from Davis Strait, 6,000 feet in depth.

"*Nonionina floridana*" Ehrenberg, Abhandl. Akad. Wiss. (Berlin), 1872 (1873) pl. 5, fig. 1, from bottom sample from Gulf Stream near Florida, 840 feet in depth.

"*Nonionina crystallina*" Ehrenberg, Die zweite deutsche Nordpolarfahrt, 1874, p. 464, pl. 1, fig. 4. Arctic, Recent.

"*Nonionina Koldeweyi*" Ehrenberg, Abhandl. Akad. Wiss. (Berlin), 1872 (1873), p. 464, pl. 1, fig. 6. Arctic, Recent.

Leidy records as "*Nonionina millepora*" and "*N. polygyra*" specimens from shore sands at Atlantic City, N. J. What these actually are is not clear.

Genus NONIONELLA Cushman, 1926

Nonionella Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, 1926, p. 64; Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 205.
Nonionina (part) of Authors.

Genoholotype.—Nonionella miocenica Cushman.

Test subtrochoid, the dorsal side only partially involute, ventral side completely so, close coiled; chambers especially in the adult inaequilateral, the ventral side developing a distinct elongate lobe at the umbilical end, which covers the umbilicus itself; wall calcareous, finely perforate; aperture at the base of the apertural face of the chamber, low and elongate, extending from the peripheral border toward the ventral side.

Cretaceous to Recent.

The subtrochoid forms belonging to this genus are close to *Nonion*, and the microspheric form may be very close to it in many species. In the megalospheric form there is a tendency to adopt the adult character at an earlier stage, and it is in this form that the trochoid character usually becomes most marked. The genus is known as far back as the Lower Cretaceous. Some of the older fossil species are as trochoid as Recent ones. The genus seems to be most at home in fairly cool waters and in the temperate zones although there are a few species in warmer waters.

NONIONELLA TURGIDA (Williamson)

Plate 6, figures 1–4

Rotalina turgida Williamson, Rec. Foram. Gt. Britain, 1858, p. 50, pl. 4, figs. 95–97.

Nonionina asterizans, var. *turgida* Parker and Jones, Introd. Foram., Appendix, 1862, p. 311.

Nonionina turgida H. B. Brady, Trans. Linn. Soc. London, vol. 24, 1864, p. 474; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 731, pl. 109, figs. 17–19.—Balkwill and Wright, Trans. Roy. Irish Acad., vol. 28, Sci., 1885, p. 352.—Terquem and Terquem, Bull. Soc. Zool. France, vol. 11, 1886, p. 331, pl. 11, figs. 7, 8.—Siddall, Proc. Lit. Phil. Soc. Liverpool, 1886, p. 71 (list).—Wright, Ann. Mag. Nat. Hist., ser. 6, vol. 4, 1889, p. 449.—Halkyard, Trans. Manchester Micr. Soc., 1889. p. 71.—Robertson, Trans. Nat. Hist. Soc. Glasgow, vol. 3, pt. 3, 1889–92, p. 242.—Chaster, First Rep't Southport Soc. Nat. Sci., 1890–91 (1892), p. 66.—Wright, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 493.—(?) Egger, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 425, pl. 19, figs. 45, 46.—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 105, pl. 17, fig. 832.—Wright, Irish Nat., vol. 9, 1900, p. 55.—Kiaer, Rep't Norwegian Fish. & Mar. Invest., vol. 1, No. 7, 1900, p. 50; in Duc d'Orleans, Crois. Ocean. Mer. Grönl., 1905 (1907), p. 562.—Millett, Rec. Foram. Galway, 1908, p. 7.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol., 31, pt. 64, 1913, p. 145; Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 281.

This is a common species especially in muddy dredgings about the British Isles. Whether the species identified with this from other regions are the same remains to be seen. The following records seem definitely to belong here: Skye, Arran, Shetland, abundant; Whitehaven, rare (Williamson); off the Dublin coast (Balkwill and Wright); south of Norway (Terquem and Terquem); Liverpool Bay, rare (Siddall); southwest of Ireland, 1,000 fathoms, frequent (Wright); Isle of Jersey (Halkyard); Portree Bay, Scotland, frequent (Robertson); off Southport, England, rather rare (Chaster); West Africa (Egger); Scandinavian coast (Goës); Dogs Bay, very rare (Wright); south coast of Norway from Brevik Fiord to the Bukn Fiord, 90 to 350 meters, and is found at Svolvaer, Lofoten, 200 meters; Vesteraalseggen, 1,187 meters (Kiaer); off Galway (Millett); Clare Island region of Ireland at 16 stations; 20 stations west of Scotland (Heron-Allen and Earland). There are records for it in the Pleistocene beds of Norway, Scotland, and Ireland.

Brady's specimens from off the Shetlands (pl. 109, figs. 17, 18) (according to Nuttall), show an equilateral face, but this is not usual in specimens I have seen from the eastern North Atlantic. Brady speaks of it, however, as follows: "This chamber is frequently developed inequilaterally, and in such cases the test assumes a Rotaliform aspect, which has been an occasional source of confusion and error."

This is a very beautiful little species and occurs abundantly in dredgings sent me by the late Joseph Wright a number of years ago. Figures of some of these are given on Plate 13.

Nonionella turgida—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
				° ′ ″ ° ′ ″				
20908	U.S.N.M.	8	D2552	39 47 07 N.; 70 35 00 W.	721	39.6	gy. oz.	Common.
20909	U.S.N.M.	4	D2535	40 03 30 N.; 67 27 15 W.	1,149	37.8	gy. oz.	Rare.
20910	U.S.N.M.	4	D2581	39 43 00 N.; 71 34 00 W.	394		gn. m.	Do
20911	U.S.N.M.	1	D2202	39 38 00 N.; 71 39 45 W.	515	39.1	gn. m.	Do
20912	U.S.N.M.	1	D2029	39 42 00 N.; 70 47 00 W.	1,168	38.5	gy. m.	Do
20923	U.S.N.M.	1	D2078	41 11 30 N.; 66 12 20 W.	499	40	gy. m. & s.	Do
10202	J.A.C.	8		Lord Bandon, Log 42, Bantry Bay southwest of Ireland.	37½			Common.
10207	J.A.C.	11		S.S. Flying Falcon, Log 8, 10 miles off Glencoe, southwest of Ireland.	53		m. s.	Abundant.
10382	J.A.C.	16		Lord Bandon, Log 28	26			Do
10178	J.A.C.	12		S. S. Flying Falcon, Log 8, off Glencoe, southwest of Ireland.	53		m. s.	Do

Genus ORBIGNYNA Hagenow, 1842

Orbignyna Hagenow, Neues Jahrb. für Min., 1842, p. 573.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 204.

Genoholotype.—Orbignyna ovata Hagenow.

Test planispiral, involute; chambers distinct, later ones with the sides continuing back over the umbilical area; wall calcareous, finely perforate; aperture in the adult, rounded, in the middle of the apertural face.

Cretaceous of Europe and America.

This genus is allied to *Nonion* and differs largely in the position of the aperture which in *Orbignyna* is rounded and in the middle of the apertural face instead of a slit between the apertural face and the preceding coil as in *Nonion*.

Genus CRIBROSPIRA Möller, 1878

Cribrospira Möller, Mém. Acad. Imp. Sci. St. Pétersbourg, ser. 7, vol. 25, no. 9, 1878, p. 86.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 204.

Genoholotype.—Cribrospira panderi Möller.

Test mostly involute, bilaterally symmetrical, at least in the adult; aperture cribrate, the numerous rounded openings in a more or less concentric grouping on the apertural face.

Carboniferous to Cretaceous (?).

Genus BRADYINA Möller, 1878

Bradyina Möller, Mém. Acad. Imp. Sci. St. Pétersbourg, ser. 7, vol. 25, no. 9, 1878, p. 78.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 205.
Nonionina (part), Eichwald, 1860 (not d'Orbigny).
Lituola (part), H. B. Brady, 1876 (not Lamarck).

Genotype, by designation.—*Bradyina nautiliformis* Möller.

Test mostly involute, bilaterally symmetrical, at least in the adult; aperture, a single opening or series of openings at the base of the apertural chamber in the middle line with a supplementary series in a crescentic line near the peripheral margin of the apertural face, connecting with the exterior after new chambers are added by a row of pits along the sutural lines.

Carboniferous.

These two genera, *Cribrospira* and *Bradyina*, are peculiar in many ways and may not belong to this family. They are mostly confined to the Palaeozoic and probably did not live after that period. Their relationship to such forms as *Endothyra* is probably close.

Genus ELPHIDIUM Montfort, 1808

Elphidium Montfort, Conch. Syst., vol. 1, 1808, p. 15.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 205.
Geophonus Montfort, Conch. Syst., vol. 1, 1808, p. 19 (genoholotype, *Nautilus macellus* Fichtel and Moll (part)).
Pelorus Montfort, Conch. Syst., vol. 1, 1808, p. 23 (genoholotype, *Nautilus ambiguus* Fichtel and Moll (part)).
Andromedes Montfort, Conch. Syst., vol. 1, 1808, p. 39 (genoholotype, *Nautilus strigillatus* Fichtel and Moll (part)).
Sorilus Montfort, Conch. Syst., vol. 1, 1808, p. 43 (genoholotype, *Nautilus strigillatus* Fichtel and Moll (part)).
Themeon Montfort, Conch. Syst., vol. 1, 1808, p. 203 (genoholotype, *Themeon rigatus* Montfort? *Nautilus crispus* Linnaeus).
Cellanthus Montfort, Conch. Syst., vol. 1, 1808, p. 207 (genoholotype, *Nautilus craticulatus* Fichtel and Moll).
Vorticialis Lamarck, Extrait Cours Zool., 1812, p. 122 (genotype, by designation, *Nautilus craticulatus* Fichtel and Moll).
Polystomella Lamarck, Hist. Anim. sans Vert., vol. 7, 1822, p. 625 (genotype, by designation, *Nautilus crispus* Linnaeus).
Robulina (part), Münster, 1838.
Geoponus Ehrenberg, Abhandl. k. Akad. Wiss. Berlin, 1839 (1841), p. 132 (genoholotype, *Geoponus stella-borealis* Ehrenberg).
Nonionina (part), Boll, 1846.
Helicozoa Moebius, Beitr. Meeresfauna Insel. Mauritius, 1880, p. 103 (genoholotype, *Nautilus craticulatus* Fichtel and Moll).

Genoholotype.—Nautilus macellus Fichtel and Moll (part).

Test typically planispiral, bilaterally symmetrical, mostly involute; chambers numerous with distinct sutures either depressed or raised and limbate, with septal bridges and depressions; wall calcareous, perforate; apertures one or more at the base of the apertural face.

Jurassic to Recent.

The retral processes characteristic of this genus are variously developed. In some primitive species they are hardly developed but in others they become very highly developed together with the canal system of the interior of the wall. In the larger tropical species of the Indo-Pacific the umbilical bosses become very highly developed with large pores, and the chambers are very numerous. There are a great many species as might be expected in such a highly developed genus, and their geographic ranges are well defined.

ELPHIDIUM ALVAREZIANUM (d'Orbigny)

Plate 7, figures 1–3

Polystomella alvareziana D'ORBIGNY, Voy. Amér. Mérid., vol. 5, pt. 5, 1839, "Foraminifères," p. 31, pl. 3, figs. 11, 12.

Test much compressed, periphery subacute, not carinate, margin entire, even, sides nearly parallel in peripheral view, umbilical regions not umbonate; chambers not inflated, 10 to 12 or more in number in the last-formed coil; sutures not depressed, marked by the retral processes which are short and broad, 7 to 8 in number; aperture composed of several rounded openings at the base of the apertural face.

Diameter, 0.60 mm.; thickness, 0.20 mm.

D'Orbigny's types were from "Patagonia, not far from the Rio Negro and in sands from the Falklands." Specimens comparable to this species as figured and described by d'Orbigny occur in material collected by Dr. Waldo Schmitt from the coast of South America and from the the Falklands. Specimens of this same general form from as far north as the West Indies may also be placed in this species.

The last chamber as mentioned by d'Orbigny and as is usual in many species of *Elphidium* is somewhat inflated, due possibly to reproductive conditions.

ELPHIDIUM INCERTUM (Williamson)

Plate 7, figures 4–9

Polystomella umbilicatula, var. *incerta* WILLIAMSON, Rec. Foram. Gt. Britain, 1858, p. 44, pl. 3, figs. 82, 82*a*.

Polystomella striato-punctata, var. *incerta* KIAER, Rept. Norwegian Fish. Mar. Invest., vol. 1, No. 7, 1900, p. 51.—CUSHMAN, Rep't Canadian Arctic Exped., pt. M, 1913, p. 10.

Polystomella decipiens HERON-ALLEN and EARLAND (not Costa), Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 282, pl. 43, figs. 20–22.

Test of small size for the genus, compressed, periphery broadly rounded, margin entire or with the last two or three chambers lobulated, umbilical regions slightly depressed, often with a slight knob or irregularly arranged slits at the base of the sutures; chambers few, usually less than ten in the last-formed whorl, slightly if at all inflated, distinct; sutures distinct, mainly marked by the openings which are in

a single row, retral processes very few, usually not more than 5 or 7, distinct, the inner ends of the sutures slit-like; wall thick, usually opaque; aperture composed of several small, rounded openings at the base of the apertural face.

Diameter, 0.50 mm.; thickness, 0.23 mm.

Williamson described and figured this variety which seems to be identical on the two sides of the Atlantic. Most of his specimens were from Scarborough, but he notes its occurrence as single specimens at other stations. On the American side of the Atlantic, it is often common in the *Albatross* dredgings at some depths, but only in deep or cold water, north of Hatteras along the continental shelf. Sherborn indicates that this is the equivalent of *E. arcticum*, but it occurs very much farther south than that species, is smaller, with fewer chambers, and a single row of a few openings along the sutures.

Elphidium incertum—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
				° ′ ″ ° ′ ″				
20924	U.S.N.M.	16	D2534	40 01 00 N.; 67 29 15 W.	1,234	37.8	gy. oz.	Abundant.
20925	U.S.N.M.	1	D2003	37 16 30 N.; 74 20 36 W.	64			Rare.
20926	U.S.N.M.	8	D2035	39 26 16 N.; 70 02 37 W.	1,362		glob. oz.	Common.
20927	U.S.N.M.	3	D2029	39 42 00 N.; 70 47 00 W.	1,168	38.5	gy. m.	Rare.
20928	U.S.N.M.	10+	D2084	40 16 50 N.; 67 05 15 W.	1,290	40	bu. m. & s.	Abundant.
20929	U.S.N.M.	3	D2073	41 54 15 N.; 65 39 00 W.	586.5	40	gy. s.	Rare.
20930	U.S.N.M.	10+	D2063	42 23 00 N.; 66 23 00 W.	141	46	s. & cr. g.	Abundant.
20931	U.S.N.M.	10+	D2052	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.	Do.
20932	U.S.N.M.	4	D2205	39 35 00 N.; 71 18 45 W.	1,073	38.1	gy. oz.	Rare.
20933	U.S.N.M.	1	D2550	39 44 30 N.; 70 30 45 W.	1,081	38.5	br. m.	Do.
20934	U.S.N.M.	2	D2563	39 18 30 N.; 71 23 30 W.	1,422	37.4	gy. oz.	Do.
20935	U.S.N.M.	13	D2535	40 03 30 N.; 67 27 15 W.	1,149	37.8	gy. oz.	Abundant.
20936	U.S.N.M.	10+	D2706	41 28 30 N.; 65 35 30 W.	1,188		br. oz. for.	Do.
20937	U.S.N.M.	1	D2196	39 35 00 N.; 69 44 00 W.	1,230	38	gn. m.	Rare.
20938	U.S.N.M.	3	D2208	39 38 00 N.; 71 16 15 W.	1,178	38.4	gn. m.	Do.
20939	U.S.N.M.	4	D2242	40 15 30 N.; 70 27 00 W.	58	51.4	gn. m.	Do.
20940	U.S.N.M.	1	D2581	39 43 00 N.; 71 34 00 W.	394		gn. m.	Do.
20941	U.S.N.M.	7	D2573	40 34 18 N.; 66 09 00 W.	1,742		gy. m. s.	Few.
10385	U.S.N.M.	8	D2052	39 40 05 N.; 69 21 25 W.	1,098	45	glob. oz.	Common.
10384	U.S.N.M.	10−	D2063	42 23 00 N.; 66 23 00 W.	141	46	s. & cr. g.	Abundant.
10343	J.A.C.	3		Vineyard Sound, Mass.				Rare.
10149	J.A.C.	10−		Spar Landing, Frenchmans Bay, Me.	15		m. s.	Abundant.
10153	J.A.C.	1		Off Stave Island., Casco Bay, Me.	11			Rare.
10155	J.A.C.	3		do	11		m. s.	Do.
10157	J.A.C.	10		do	9		m. s.	Common.
10158	J.A.C.	6		do	9		m. s.	Few.
10159	J.A.C.	9		do	9		m. s.	Common.
10165	J.A.C.	7		Upper end, Buzzards Bay, Mass.	3		m. s.	Few.
10169	J.A.C.	1		do	3		m. s.	Rare.
10213	J.A.C.	1		Cobscook Bay, Eastport, Me.				Do.
10219	J.A.C.	1		Cove between Lubec and Quoddy Head, Me.				Do.
3376	J.A.C.	1		Hudson Bay, James Bay	10			Do.
3377	J.A.C.	1		do	10			Do.
3378	J.A.C.	1		do	15–20			Do.
3379	J.A.C.	1		do	4–5			Do.
3381	J.A.C.	10		Hudson Bay, Black Whale Harbor, lat. 55° N.	10			Common.
3382	J.A.C.	3		do	10			Rare.

This form is recorded by Kiaer and Awerinzew from the Arctic of Siberia, Greenland, and off the coast of Norway. I had it from the Canadian Arctic Expedition.

The form figured by Heron-Allen and Earland from the west of Scotland as "*Polystomella decipiens* Costa" is this species. Their Figure 21 is very close to the figures of *incerta* from the same general region. Costa's species evidently has a granular umbilical region and is a different species, the original figure showing a somewhat keeled specimen.

ELPHIDIUM INCERTUM (Williamson), var. CLAVATUM, new variety

Plate 7, figure 10 *a*, *b*

Variety differing from the typical in the ornamentation of the test, the umbilical portions being occupied by several large irregular bosses, very distinct but not forming a definite umbonate mass, test usually yellowish-brown in color.

Holotype (Cushman Coll. No. 10400) from Spar Landing, Frenchmans Bay, Me.

This variety is common on the coasts of New England and northward. It occurs on the northern coast of Europe as well.

ELPHIDIUM STRIATO-PUNCTATUM (Fichtel and Moll)

There are very many Atlantic records referred to this species. The types of Fichtel and Moll were from the Arabian Sea, and are very different from the many forms assigned by later authors to this species. Some of these forms will be found here under *Elphidium incertum* (Williamson), *E. excavatum* Terquem, etc.

For the type form of *Elphidium macellum* (Fichtel and Moll) see Cushman and Leavitt.[3]

ELPHIDIUM MACELLUM (Fichtel and Moll)

Although this species is recorded from the Atlantic by authors, the specimens I have seen are not the same as this species as developed at the type locality in the Mediterranean.

For the type form of *Elphidium macellum* (Fichtel and Moll) see Cushman and Leavitt.[4]

ELPHIDIUM CRISPUM (Linnaeus)

Numerous authors have recorded "*Polystomella crispa*" from the eastern coast of the Atlantic. Williamson in 1858 figured specimens such as occur off the southern coast of England and which are reproduced here. These are not the same as the Mediterranean types of *Elphidium crispum*, but are more like *E. macellum* in some of their characters. The early stages have a series of sharp spines about the periphery but these are usually reduced and finally wanting in the adult. In some respects these forms are close to d'Orbigny's

[3] Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 10, pl. 4, figs. 5, 6.
[4] Idem., vol. 5, 1929, p. 18, pl. 4, figs. 1, 2.

"*Polystomella aculeata*" from the Vienna Basin. These are left for a more intensive study of this genus now under way. Nothing of the sort occurs so far as I have seen in material from the western side of the Atlantic.

For the type form of *Elphidium crispum* (Linnaeus) see Cushman and Leavitt.[5]

ELPHIDIUM EXCAVATUM (Terquem)

Plate 8, figures 1–7

Polystomella excavata TERQUEM, Essai Class. Anim. Dunkerque, 1875, p. 25, pl. 2, figs. 2 *a–f*.

Polystomella umbilicatula WILLIAMSON (not Walker and Jacob), Rec. Foram. Gt. Britain, 1858, p. 42, pl. 3, fig. 81.

Test of small size for the genus, much compressed, periphery broadly rounded, margin entire or slightly lobulate, umbilical regions usually slightly depressed, sometimes with one or more small, rounded bosses; chambers few, 8 to 10 making up the last-formed coil, slightly if at all inflated; sutures distinct, very slightly depressed, marked by the very short, narrow, retral processes with wide openings, between 8 and 10 in number, usually rather even and distinct; wall smooth; aperture composed of a row of small, rounded pores at the base of the apertural face.

Diameter, 0.40 mm.; thickness, 0.12 mm.

This species described and figured by Terquem from off the Atlantic coast of France seems to represent well a common species found on the coasts of Belgium and about the British Isles. It is somewhat like *E. incertum* (Williamson), but is more compressed, has the retral processes more even and in larger numbers, and the umbilical region is different. It has passed under the general name of "*Polystomella striato-punctata*" but as noted is not that species. Williamson's figured specimen referred to above is probably the same as Terquem's species.

Var. *selseyensis* Heron-Allen and Earland, from off the southern coast of England is probably a form of this with a somewhat more open coil.

ELPHIDIUM OWENIANUM (d'Orbigny)

Plate 8, figures 10–12

Polystomella oweniana D'ORIBIGNY, Voy. Amér. Mérid., vol. 5, pt. 5, 1839, "Foraminifères," p. 30, pl. 3, figs. 3, 4.

Test of medium size for the genus, somewhat compressed, periphery subacute, margin entire, greatest thickness in peripheral view at the umbilical regions which are not distinctly umbonate; chambers numerous, distinct, not inflated, averaging about 15 in the last-formed coil; sutures distinct, limbate, the retral processes elongate,

[5] Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 20, pl. 4, figs. 3, 4.

rod-like, occupying almost the entire height of the chamber; aperture, a series of rounded openings at the base of the apertural face.

Diameter, 0.75 mm.; thickness, 0.30 mm.

D'Orbigny described this species from the "coast of Patagonia, to the south of the Rio Negro." It is distinct from the other species of this region in its thickening at the umbilical region in peripheral view and the subacute margin and distinct sutures.

ELPHIDIUM LESSONII (d'Orbigny)

Plate 9, figures 1–4

Polystomella lessonii D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 284, No. 6; Voy. Amér. Mérid., vol. 5, pt. 5, 1839, "Foraminifères," p. 29, pl. 3, figs. 1, 2.

Polystomella macella H. B. BRADY (part) (not Fichtel and Moll), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 110, fig. 9 (not 8, 10, 11).

Test of large size for the genus, compressed, periphery rounded, margin very slightly lobulate, sides nearly parallel in peripheral view, umbilical regions not umbonate but occupied by a group of irregular raised areas; chambers numerous, 20 to 22 in the last-formed whorl, slightly inflated; sutures sigmoid, indistinct except as marked by the retral processes which are prominent, elongate, rod-like usually 15 or more, extending nearly the whole width of the chamber, the interspaces deep; aperture, a series of rounded openings at the base of the apertural face.

Diameter, 1.20 mm.; thickness, 0.35 mm.

D'Orbigny's type locality for this species is given as "coast of Patagonia, to the south of Rio Negro." His specimen was evidently a young, immature specimen. It has proved to be abundant and very well developed in Doctor Schmitt's collections from the Falklands. at some stations the dominant species.

This is one of the most beautifully sculptured species of the genus and hardly to be confused with any other. Its distribution appears to be rather limited so far as material available shows, as it has occurred only in the South Atlantic.

The young specimens are very close to the figure given by d'Orbigny, but the adults have a more rounded periphery and more chambers.

Brady's specimen from the Falklands noted above is this species probably.

ELPHIDIUM DISCOIDALE (d'Orbigny)

Plate 8, figures 8–9

Polystomella discoidalis D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839 "Foraminifères," p. 56, pl. 6, figs. 23, 24.—CUSHMAN, Publ. 311, Carnegie Instit. Washington, 1922, p. 56, pl. 10, figs. 3, 4; Publ. 344, 1926, p. 80.

Test of medium size for the genus, somewhat compressed, periphery subacute, margin slightly lobulate, sides convex in peripheral view,

umbilical regions each with a large rounded boss, in peripheral view protruding strongly beyond the outline of the test; chambers only slightly inflated, distinct, averaging about 10 in number in the last-formed coil; sutures slightly depressed, somewhat broadening toward the inner end, marked also by the retral processes which are short, and 10 to 12 in number; wall smooth, very distinctly perforate, umbos of clear shell material, nearly transparent, with numerous coarse tubules; aperture composed of several, small, rounded openings at the base of the apertural face.

Diameter, 0.65 mm.; thickness, 0.30 mm.

D'Orbigny described this species from shore sands from Cuba and Jamaica, recording it as common. It has a general West Indian distribution.

The species is close to *E. lanieri* (d'Orbigny), and is to be distinguished from it mainly by the less prominent retral processes, the more depressed sutures, the more prominent umbos, and the smaller number of chambers.

ELPHIDIUM LANIERI (d'Orbigny)

Plate 9, figure 7

Polystomella lanieri D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 54, pl. 7, figs. 12, 13.—CUSHMAN, Publ. 291, Carnegie Instit. Washington, 1919, p. 49.

Test of medium size for the genus, periphery subacute, margin entire, not lobulate; sides convex in peripheral view giving a rhomboid outline to the test, umbilical regions each with a large rounded boss in peripheral view forming the greatest width of the test but continuous with the sides; chambers not inflated, distinct, numerous, averaging 18 to 20 in the last-formed coil; sutures not depressed, marked by the retral processes which are short, 10 to 12 in number and slightly oblique, those of the earlier portion tending to merge into oblique lines; wall smooth, distinctly perforate, translucent, the bosses of clear material with numerous tubular perforations; aperture composed of several, small, rounded openings at the base of the apertural face.

Diameter, 0.60 mm.; thickness, 0.40 mm.

D'Orbigny's types of this species were from shore sands of Cuba. I have recorded it from the Late Tertiary of Rio Cana, Cercado de Mao, Santo Domingo and from the gorge of the Yumuri River, Matanzas, Cuba. The specimens I have noted from Porto Rico and from the Miocene of Yellow River, Florida, belong under *E. sagrum* (d'Orbigny) as noted under that species.

In the earlier work on the Recent West Indian collections, I often included *E. lanieri* and *E. discoidale* under the latter species.

ELPHIDIUM SAGRUM (d'Orbigny)

Plate 9, figures 5–6

Polystomella sagra D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères", p. 55, pl. 6, figs. 19, 20.—CUSHMAN, Bull. 103, U. S. Nat. Mus., 1918, p. 75, pl. 26, figs. 5 *a*, *b*; Publ. 291, Carnegie Inst., Washington, 1919, p. 49; U. S. Geol. Survey, Prof. Paper 128–B, 1920, p. 71, pl. 11, figs. 20, 21.

Polystomella lanieri CUSHMAN (not d'Orbigny), U. S. Geol. Survey, Prof. Paper 128–B, 1920, p. 72, pl. 11, fig. 22; Publ. 344, Carnegie Instit. Washington, 1926, p. 80.

Test of small size for the genus, periphery broadly rounded, margin entire, not lobulate, sides convex in peripheral view, the last-formed portion wider than the earlier portions, umbilical regions depressed; chambers in the last portion slightly inflated, fairly distinct, 12 to 15 in the last-formed coil; sutures not depressed, except between the last few chambers, marked by the retral processes about 10 in number, short and broad, continuous over the earlier portion of the test to form ridges slightly oblique to the periphery; wall fairly thick, perforate; aperture composed of a series of small, rounded openings at the base of the apertural face.

Diameter, 0.55 mm.; thickness, 0.33 mm.

D'Orbigny's types of this species were from shore sands of Cuba where it is recorded as rare. It occurs very rarely in the Recent collections from the West Indian region but seems to be more common in the Late Tertiary of the same region, occurring in Florida, Cuba, and Santo Domingo. The character of the distinct costae and the shape in peripheral view will distinguish this species from others in the region.

Elphidium sagrum—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
10005	J.A.C.	3	8	Between Boaz Island and Somerset, Bermuda.			s	Common.
3329	J.A.C.	1	9	Porto Rico	0.5			Rare.
3330	J.A.C.	2	4	do	1			Do.
3331	J.A.C.	1	5	do	3.3			Do.
3332	J.A.C.	8	5	do	3.3			Common.
3333	J.A.C.	6	8	do	2			Few.
9954	J.A.C.	3		Havana Harbor, Cuba				Rare.

ELPHIDIUM ADVENUM (Cushman)

Plate 10, figures 1–2

Polystomella subnodosa H. B. Brady (not von Münster), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 734, pl. 110, figs. 1 *a*, *b*.—Chapman, Journ. Linn. Soc. Zool., vol. 28, 1902, p. 203.—Millett, Journ. Roy. Micr. Soc., 1904, p. 604.—Bagg, Proc., U. S. Nat. Mus., vol. 34, 1908, p. 165.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 733.

Polystomella advena Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 56, pl. 9, figs. 11, 12; Publ. 342, 1924, p. 48; Publ. 344, 1926, p. 80.

Test of medium size for the genus, strongly compressed, periphery acute, with a narrow carina, somewhat lobulate, sides nearly parallel in peripheral view, umbilical regions depressed, often with a small central boss of clear shell material but in peripheral view not projecting beyond the contour of the test; chambers distinct, 10 to 15 in the last-formed coil, slightly inflated, especially in the last-formed portion; sutures depressed, marked by the retral processes which are short, about one-fourth the width of the chamber, 12 to 15 in number; wall smooth, translucent, finely and distinctly perforate; aperture composed of a series of small rounded pores at the base of the apertural face.

Diameter, up to 0.50 mm.; thickness, 0.15 mm.

The types of this species are from the Tortugas region off southern Florida. The species is well distributed in warm, shallow water of tropical regions. It is very different from von Münster's species from the Oligocene of northern Germany. It is not as common in the West Indian region as are several of the other species.

It apparently occurs in the Late Tertiary of the West Indian region.

ELPHIDIUM ADVENUM (Cushman), var. MARGARITACEUM, new variety

Plate 10, figure 3

Variety differing from the typical mainly in the character of the wall which in the variety is pearly and coarsely perforate, giving a very distinctive appearance to the test.

Holotype (Cushman Coll. No. 10227), from beach at Newport, R. I. It appears to be a northern variety of the more tropical *E. advenum* and somewhat similar specimens appear off the coasts of Europe.

ELPHIDIUM POEYANUM (d'Orbigny)

Plate 10, figures 4–5

Polystomella poeyana d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères", p. 55, pl. 6, figs. 25, 26.—Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 55, pl. 9, figs. 9, 10; Publ. 344, 1926, p. 79.

Test of small size for the genus, strongly compressed, periphery broadly rounded, margin slightly lobulate, sides nearly parallel in peripheral view, umbilical regions slightly depressed; chambers averaging 10 to 12 in number in the last-formed coil but variable, very

slightly inflated, very distinct; sutures slightly depressed, marked by the very short, broad retral processes, averaging about 15 in number; wall thin, translucent, smooth, conspicuously but finely perforate; aperture composed of a series of small, rounded openings at the base of the apertural face.

Diameter, 0.50 mm.; thickness, 0.20 mm.

D'Orbigny described and figured this species from shore sands of Cuba and Jamaica. It has proved to be the most common species of the genus in the general West Indian region. It is one of those species which has been included under "*Polystomella striato-punctata*" but is very different from that species.

There is a considerable amount of variation in the specimens of this species, in the shape, which is often somewhat longer than broad and especially in the number of the chambers. In its general characters, however, it is distinct from any other in the region.

Elphidium poeyanum—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
						°C		
3349	J.A.C.	4	10	Dry Tortugas, Fla	11	23.2	s	Rare.
3350	J.A.C.	1	12	do	7	23	s	Do.
3352	J.A.C.	1	8	do	½		s	Do.
3354	J.A.C.	10+	19	do	5.75		fne. s	Abundant.
3355	J.A.C.	10+	28	do	7		fne. s	Do.
3356	J.A.C.	10+	18	do	7		fne. s	Do.
3359	J.A.C.	5	14	do	12		fne. s	Few.
3361	J.A.C.	10	8	Porto Rico	2			Common.
3362	J.A.C.	6	2	do				Few.
3363	J.A.C.	10	1	do				Common.
3364	J.A.C.	6	5	do	⅙			Few.
3365	J.A.C.	8	9	do		96		Common.
3366	J.A.C.	10+	7	do	2.5			Abundant.
3367	J.A.C.	6	6	do	1.5			Few.
3368	J.A.C.	10	4	do	1			Common.
3370	J.A.C.	3		Featherbed Banks, Biscayne Bay, Fla.				Rare.
3373	J.A.C.	2		Montego Bay, Jamaica	10			Do.
3388	J.A.C.	2	13	Dry Tortugas, Fla	11		fne. s	Do.
20945	U.S.N.M.	1		Off Miami, Fla	20			Do.
20946	U.S.N.M.	4		Off Fowey Rocks, Fla	65			Do.
3286	J.A.C.	1	21	Dry Tortugas, Fla	6		fne. s	Do.
3345	J.A.C.	2	27	do	7		m. fne. s	Do.
3346	J.A.C.	2	30	do	2		s	Do.
3347	J.A.C.	10+	28	do	4.75		fne. s	Abundant.
3348	J.A.C.	5	37	do	11		fne. s	Few.
3351	J.A.C.	6	42	do	18		s	Do.
3353	J.A.C.	10+	27	do	7		m. fne. s	Abundant.
3357	J.A.C.	10+	22	do	6		fne. s	Do.
3358	J.A.C.	10+	21	do	6		fne. s	Do.
3360	J.A.C.	10+	23	do	10.5		m. s.	Do

ELPHIDIUM ARTICULATUM (d'Orbigny)

Plate 10, figures 6–8

Polystomella articulata D'Orbigny, Voy. Amér. Mérid., vol. 5, pt. 5, 1839, "Foraminifères," p. 30, pl. 3, figs. 9, 10.

Test small, somewhat compressed, periphery rounded, margin slightly lobulate, sides nearly parallel in peripheral view, umbilical regions slightly depressed; chambers averaging 10 in number in the last-formed coil, slightly inflated; sutures slightly depressed, marked

also by the retral processes which are very short and broad, averaging about 10 in number; aperture composed of several rounded openings at the base of the apertural face.

Diameter, 0.50 mm.; thickness, 0.22 mm.

D'Orbigny's types were from "the coast of Patagonia, near the Rio Negro, and also from the Falklands." The species is common in this region in the collections made by Dr. Waldo Schmitt. It is a smooth, polished species with a fairly thick wall which may be distinguished from *E. poeyanum* (d'Orbigny) of the West Indian region which somewhat resembles this. Both of these species have been included under the name "*Polystomella striato-punctata*" but are very different from that species as has been noted.

ELPHIDIUM ARCTICUM (Parker and Jones)

Plate 11, figures 1–6

Polystomella arctica Parker and Jones, in H. B. Brady, Trans. Linn. Soc. Zool., vol. 24, 1864, p. 471, pl. 48, fig. 18.—Dawson, Canad. Nat., vol. 5, 1870, p. 177, pl., fig. 8; Amer. Journ. Sci., ser. 3, vol. 1, 1871, p. 206, fig. 8; Ann. Mag. Nat. Hist., ser. 4, vol. 7, 1871, p. 86, fig. 8.—H. B. Brady, Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 437, pl. 21, figs. 13 *a–d;* Ann. Mag. Nat. Hist., ser. 5, vol. 8, 1881, p. 415; Denkschr. Akad. Wiss., Math.-Nat. Cl., vol. 43, 1881, p. 18; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 735, pl. 110, figs. 2–5.—Woodward, The Observer, vol. 4, 1893, p. 201.—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 100, pl. 16, fig. 813.—Awerinzew, Mém. Acad. Imp. Sci., St. Pétersbourg, ser. 8, vol. 29, No. 3, 1911, p. 26.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 146.—Cushman, Rep't Canadian Artic Exped., pt. M, 1913, p. 11.—Heron-Allen and Earland, Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 283.—Cushman, Contrib. Canadian Biol., 1921 (1922), p. 14.—(?) Koch, Ber. Schweiz. Pal. Ges., vol. 18, 1923, p. 357.

Polystomella crispa Linnaeus, var. *arctica* Parker and Jones, Phil. Trans., vol. 155, 1865, p. 401, pl. 14, figs. 25–30.

Nonionina boueana Balkwill and Wright, Trans. Roy. Irish Acad., vol. 28, Sci., 1885, p. 353, pl. 13, fig. 27.

Test of comparatively large size for the genus, compressed, periphery broadly rounded, margin only slightly lobulate, umbilical regions slightly depressed, smooth; chambers comparatively few, 10 to 12 in the last-formed coil, very slightly inflated; sutures distinct, slightly depressed, marked by a double row of rounded pores, no distinct retral processes; wall apparently sometimes double, often slightly rugose; aperture consisting of a row of small rounded pores at the base of the apertural face with occasionally a second row slightly above it.

Diameter, 1.25 mm.; thickness, 0.50 mm.

The types of this species were described and figured by Parker and Jones in Brady's Shetland paper. The species is widely distributed in the Arctic and North Atlantic; Gulf of St. Lawrence (Daw-

son, Whiteaves), "Common in Baffins Bay and Smith Sound, as far north as lat. 82° 27′ N., at every depth down to 210 fathoms; off the Hunde Islands, Davis Strait, 25 to 70 fathoms; on the shores of Spitzbergen, 7 fathoms; off Franz-Joseph Land, lat. 79° to 80° N., 108 to 125 fathoms; and off Novaya Zemlya, 55 to 93 fathoms. It is comparatively rare in the Faröe Channel and the Shetland Seas; and its southern limit, so far as at present known, is reached on the western coast of Scotland" (H. B. Brady in *Challenger* Report); Kish Bank, 24 fathoms (Balkwill and Wright); Clare Island region of Ireland, 11 fathoms, *Goldseeker* stations in the North Sea and Faröe Channel, in the Buchan Deep of the North Sea near Rattray Head, east coast of Scotland and eight *Runa* stations west of Scotland (Heron-Allen and Earland); Siberian Arctic (Awerinzew); Canadian Arctic and Hudson Bay (Cushman).

The double row of pores is due to a splitting of the canal from the chamber cavity as shown by Brady's figures in the *Challenger* Report and copied here. The other Arctic species, *E. sibiricum* (Goës) also has this same character.

Wright records the species as occurring in the Pleistocene of Ireland

Elphidium arcticum—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
				° ′ ″ ° ′ ″				
20942	U.S.N.M.	3	D2078	41 11 30 N.; 66 12 20 W.	499	40	gy. m. & s.	Rare.
20943	U.S.N.M.	2	D2029	39 42 00 N.; 70 47 00 W.	1,168	38½	gy. m.	Do.
20944	U.S.N.M.	1	Goldseeker	61° 34′ N., 2° 4′ E.	[1]293			Do.
10163	J.A.C.	3		Upper end, Buzzards Bay, Mass.	3		m., s.	Do.
10170	J.A.C.	5		do	3		m., s.	Few.
10242	J.A.C.	1		Hampton Beach, N. H.				Rare.
10154	J.A.C.	2		Off Stave Island, Casco Bay, Me.	11		m., s.	Do.
10160	J.A.C.	3		Off Bates Island, Casco Bay, Me.	9		m., s.	Do.
10215	J.A.C.	10+		Penobscot Bay, Me.				Abundant.
10220	J.A.C.	1		Cove between Lubec and Quoddy Head, Me.				Rare.
10218	J.A.C.	6		do				Few.
10232	J.A.C.	10+		Cobscook Bay, Eastport, Me.				Abundant.
10235	J.A.C.	10+		Eastport, Me.				Do.
10216	J.A.C.	10+		Off Trials Island, Eastport, Me.				Do.
3297	J.A.C.	2		Hudson Bay, south of Black Whale Harbor, lat. 55° N.	10			Rare.
3298	J.A.C.	2		do	10			Do.
3384	J.A.C.	10		Hudson Bay, Gray Goose Island.	10			Common.
3385	J.A.C.	8		Hudson Bay, south of Black Whale Harbor, lat. 55° N.	10			Do.
3389	J.A.C.	10+		Hudson Bay, Gray Goose Island.	10			Abundant.
3391	J.A.C.	1		Hudson Bay, James Bay.	4–5			Do.
3390	J.A.C.	4		Hudson Bay, Richmond Gulf.	15–20			Do.
3092	J.A.C.	4		do	15–20			Do.
3299	J.A.C.	3		Gaspé Bay	30–40			Do.
10194	J.A.C.	5		Coast of Iceland				Few.
10209	J.A.C.	1		Kiollie Fjord, Norway	4		s.	Rare.

[1] Meters.

ELPHIDIUM SIBIRICUM (Goës)

Plate 11, figure 7

Polystomella sibirica Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 100, pl. 17, fig. 814.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 4, 1914, p. 34, pl. 19, fig. 1.—Chapman, New Zealand Geol. Survey, Pal. Bull., No. 11, 1926, p. 89, pl. 17, fig. 14.

Test of very large size for the genus, strongly compressed, periphery rounded, slightly lobulate, umbilical regions slightly depressed and the coils not completely involute, exposing some of the early coils in the central region; chambers numerous, as many as 25 in the last-formed coil, very slightly inflated; sutures distinct, very slightly depressed, marked by a single or double line of pores; wall smooth; aperture consisting of numerous small rounded pores in an inverted V-shaped arrangement.

Diameter, up to 4 mm.; thickness, 0.30 mm.

Goës described this species from off Nova Zembla in shallow water at about 15 fathoms. I have recorded typical specimens from *Albatross* Station D 3600 in 156 fathoms in Bering Sea. It is to be looked for in shallow water of the Arctic bordering on the North Atlantic.

Genus POLYSTOMELLINA Yabe and Hanzawa, 1923

Polystomellina Yabe and Hanzawa, Jap. Journ. Geol. Geog., vol. 2, 1923, p. 99.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 208.

Genoholotype.—Polystomella (*Polystomellina*) *discorbinoides* Yabe and Hanzawa.

Test similar to *Elphidium* in general structure but trochoid, planoconvex, ventral side flattened, dorsal side convex.

Tertiary and Recent.

The species of this genus seem to be largely confined to the Pacific region. No species are recorded from any part of the Atlantic.

Genus FAUJASINA d'Orbigny, 1839

Faujasina d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 109.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 208.

Genoholotype.—Faujasina carinata d'Orbigny.

Test similar to *Elphidium* but trochoid, planoconvex, dorsal side flattened, ventral side convex.

Cretaceous to Recent.

Some of the fossil species of this genus become very abundant at restricted localities. It was probably an attached form. There do not seem to be any living Atlantic species.

Family 25. CAMERINIDAE

Test generally planispiral and bilaterally symmetrical, in the early stages involute, in the later stages often evolute; wall calcareous, perforate; in the higher forms with a secondary skeleton and complex canal system.

This family evidently started very early and there are Carboniferous forms which apparently are the earliest beginnings of the group, although the family did not reach its greatest development until the Eocene. During that geologic period very large species were developed and were very abundant, especially in the Eastern Hemisphere. In America, *Operculina* and *Heterostegina* were large and abundant during the Middle and Upper Eocene, but the very large complex Nummulites evidently did not migrate to this region. In the shallow waters of the Indo-Pacific there are still living many large forms related to the Eocene ones but in the western Atlantic the family is almost wanting, the only genus represented in the collections studied being *Heterostegina*, and that is evidently very rare.

Subfamily 1. ARCHAEDISCINAE

Test not broken up into chambers.

Genus ARCHAEDISCUS H. B. Brady, 1873

Archaediscus H. B. BRADY, Ann. Mag. Nat. Hist., ser. 4, vol. 12, 1873, p. 286.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 209.

Genoholotype.—Archaediscus karreri H. B. Brady.

Test lenticular, consisting of a proloculum and long undivided second chamber, close coiled; wall thick, calcareous, finely perforate, upper and lower surfaces thickened; aperture at the open end of the chamber.

Carboniferous.

Subfamily 2. CAMERININAE

Test with numerous chambers.

Genus NUMMULOSTEGINA Schubert, 1907

Nummulostegina SCHUBERT, Verhandl. k. k. Geol. Reichs., 1907, p. 212.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 209.

Genoholotype.—Nummulostegina velibitana Schubert.

Test lenticular, planispiral, bilaterally symmetrical, divided into chambers, without complex secondary skeleton or canal system;

wall calcareous, perforate; aperture narrow, at the base of the apertural face.

Carboniferous.

Genus CAMERINA Brugière, 1792

Camerina Brugière, Ency. Method., "Vers," pt. 1, 1792, p. 395.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 210.

Nautilus (part) of Authors.

Phacites Blumenbach, Abbild. Nat. Gegenstände, heft 4, no. 40, 1799, pl. 40 (genoholotype, *Phacites fossilis* Blumenbach).

Nummulites Lamarck, Syst. Anim. sans Vert., vol. 9, 1801, p. 101 (genoholotype, *Camerina laevigata* Brugière).

Lenticulina Lamarck (part), Ann. Mus., Paris, vol. 5, 1804, p. 186.

Nummulites Montfort, Conch. Syst., vol. 1, 1808, p. 155 (genoholotype, *Nummulities denarius* Montfort).

Lycophris Montfort, Conch Syst., vol. 1, 1808, p. 159 (genoholotype, *Nautilus lenticularis* Fichtel and Moll (part)).

Egeon Montfort, Conch Syst., vol. 1, 1808, p. 167 (genoholotype, *Nautilus lenticularis* Fichtel and Moll (part)).

Nummulina d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 295 (genotype, by designation, *Camerina laevigata* Brugière).

Nummularia Sowerby, Min. Conch., vol. 6, 1826, p. 76 (genotype, by designation, *Camerina laevigata* Brugière).

Amphistegina (part), Reuss, 1855.

Genotype, by designation.—*Camerina laevigata* Brugière.

Test lenticular, planispiral, bilaterally symmetrical, involute; wall perforate, calcareous, with a secondary skeleton and complicated canal system; aperture simple at the base of the apertural face, median.

Carboniferous (?) to Oligocene.

There are many subgeneric names for this and the following not given here.

Genus ASSILINA d'Orbigny, 1826

Assilina d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 296 (as a subgenus of *Nummulina*).—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 212.

Nummulites (part) of Authors.

Genotype, by designation.—*Assilina discoidalis* d'Orbigny.

Test similar to *Camerina* but the test flattened, the chambers usually not completely involute so that the earlier coils are not covered, or with the wall very thin so that the earlier coils are visible from the exterior.

Eocene.

Genus OPERCULINELLA Yabe, 1918

Operculinella Yabe, Sci. Rep. Tohoku Imp. Univ., ser. 2, (Geol.), vol. 4, 1918, p. 122.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 212.

Amphistegina W. B. Carpenter, 1859, (not d'Orbigny).

Nummulites H. B. Brady, 1884 (not Lamarck).

Genoholotype.—Amphistegina cumingii W. B. Carpenter.

Test lenticular and involute in the young, bilaterally symmetrical, in the adult with a broadly flaring complanate border; chambers simple; aperture at the base of the apertural face, median.

Late Tertiary and Recent. Indo-Pacific.

Genus OPERCULINA d'Orbigny, 1826

Operculina d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 281.
Nautilus (part) of Authors.
Lenticulites (part) Defrance, 1822.
Amphistegina (part) d'Orbigny, 1826.
Nonionina (part) Williamson, 1852.
Nummulina (part) Parker and Jones, 1865.

Genotype, by designation.—*Operculina complanata* d'Orbigny.

Test bilaterally symmetrical, planispiral, complanate, usually all the coils visible from the exterior, earlier coils sometimes involute; wall calcareous, perforate, smooth or ornamented with bosses; aperture single, at the base of the apertural face, median.

Lower Cretaceous to Recent.

There are many records, especially from the North Atlantic, referred to "*Operculina ammonoides* (Gronovius)." This small species is not an *Operculina*, but belongs with the Anomalinidae, and should be known as *Planulina ammonoides* (Gronovius) and will be taken up in the next part of this work.

True Operculinas are apparently not found in the Atlantic although they occurred in the West Indian region abundantly in the Upper Eocene and less so in the Oligocene. They are still persistent and reach large size in the warm shallow waters of the Pacific.

Genus HETEROSTEGINA d'Orbigny, 1826

Heterostegina d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 305.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 213.

Genotype, by designation.—*Heterostegina depressa* d'Orbigny.

Test similar to *Operculina*, the early chambers simple, later ones divided into chamberlets; aperture consisting of a row of rounded openings on the narrow apertural face.

Eocene to Recent.

This genus reached its climax in the Upper Eocene, and is now represented in the Atlantic only in the West Indian region, and there by but a single species. It is represented in the tropical Pacific by large fine species which have still persisted and find their natural habitat in warm waters of less than 30 fathoms.

HETEROSTEGINA ANTILLARUM d'Orbigny

Plate 12, figures 1, 2

Heterostegina antillarum d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 121, pl. 7, figs. 24, 25.—Cushman, Publ. 311, Carnegie Inst. Washington, 1922, p. 57, pl. 10, fig. 5.

Heterostegina depressa (part) H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 746.

Test comparatively small for the genus, close coiled throughout, not complanate, greatest thickness in the umbonal region, thence sloping to the subacute periphery; chambers strongly curved, narrow, the outer portion divided up into a single row of chamberlets, those of each chamber not connecting with one another; sutures distinct, slightly limbate, not depressed; wall smooth; aperture consisting of a few pores on the apertural face.

Diameter, about 2 mm.

D'Orbigny records this species from shore sands of Cuba and Jamaica, but notes that he had but few specimens and that it is apparently rare. It is worthy of note that the two stations at the Dry Tortugas, off Florida, where I found the species, were both in abnormally warm water for the region, and it may be that the species is only holding on in such favorable localities. I did not find it in material from Porto Rico, Cuba, or Jamaica in the collections I have examined from these localities. A single typical specimen from *Albatross* Station D-2758, from the east coast of Brazil, in 20 fathoms, shows that it has the same general distribution as others of the West Indian fauna. More collecting will undoubtedly increase its known distribution in the region.

Heterostegina antillarum—Material examined

Cat. No	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
20863	U.S.N.M.	1	D2758	6° 59′ 30″ S.; 34° 47′ 00″ W.	20	79	brk. sh	Rare.
3548	J.A.C.	2	20	Dry Tortugas, Fla				Do.
3549	J.A.C.	1	8	do	⅓		s	Do.
3550	J.A.C.	1	9	do	⅙		s	Do.

Genus SPIROCLYPEUS H. Douvillé, 1905

Spiroclypeus H. Douvillé, Bull. Soc. Geol. France, ser. 4, vol. 4, 1905, p. 458.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 213.

Genotype, by designation.—*Spiroclypeus orbitoideus* H. Douvillé.

Test somewhat similar to *Heterostegina* but more accelerated, the curved chambers divided into chamberlets beginning almost immedi-

ately after the proloculum, lateral chambers and pillars developed at each side of the test.

Miocene of the East Indies.

Genus HETEROCLYPEUS Schubert, 1906

Heteroclypeus Schubert, Centralbl. für Min., 1906, p. 640.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 214.

Genoholotype.—Heterostegina cycloclypeus A. Silvestri.

Test similar to *Heterostegina* in the young, but the chambers becoming annular in the later development.

Tertiary.

Genus CYCLOCLYPEUS W. B. Carpenter, 1856

Cycloclypeus W. B. Carpenter, Phil. Trans., 1856, p. 555.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 214.

Genotype, by designation.—*Cycloclypeus carpenteri* H. B. Brady.

Test in the microspheric form like *Heterostegina* in the early stages, later with the chambers becoming annular, divided by radial portions into rectangular chamberlets, the test discoidal and much compressed.

Miocene to Recent.

Family 26. PENEROPLIDAE

Test imperforate except the proloculum and second chamber which are distinctly perforate, calcareous, in general planispiral in the young, then becoming annular or uncoiling; chambers typically divided into chamberlets in all but the most primitive genera; aperture in the simpler forms slit-like, becoming multiple in the complex forms or rounded and terminal in the uncoiled forms.

Subfamily 1. Spirolininae

Test close coiled in the young, often becoming uncoiled in the adult.

Genus PENEROPLIS Montfort, 1808

Peneroplis Montfort, Conch. Syst., vol. 1, 1808, p. 259.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 217.

Coscinospira Ehrenberg, Abhandl. k. Akad. Wiss. Berlin, 1838, p. 131 (genotype, by designation, *Coscinospira hemprichii* Ehrenberg).

Genoholotype.—Peneroplis lanatus Montfort = *Nautilus planatus* Fichtel and Moll.

Test free, planispiral, close coiled in the young, usually involute, in the adult becoming variously shaped, close coiled, flaring, annular or commencing to uncoil; chambers undivided; wall calcareous, imperforate except in the proloculum and sometimes the following

chamber; aperture simple, at the base of the apertural face, or long and slit-like, occasionally divided.

Cretaceous (?) Tertiary and Recent.

This genus as well as the whole family are characteristic of warm shallow waters and generally coral-reef conditions. They often occur in great numbers and show a great deal of variation. Double and monstrous forms are not unusual. The student of this and allied genera is referred to the work of Dreyer.[6] In the Atlantic the genus is most abundant in the general West Indian region. Little is known of it from the eastern tropical Atlantic.

Numerous writers have considered all the forms of *Peneroplis* as varieties of a single species. Brady adopted this grouping in the *Challenger* report, and many later authors have followed him. In 1915, Heron-Allen and Earland in their paper on the Recent Foraminifera of the Kerimba Archipelago, examined the early descriptions and figures with the result that they used five distinct specific names in their report. Some of these belong in other genera as now recognized, and to them must be added certain species of d'Orbigny based on material from the West Indies as well as one described by Dr. J. M. Flint from material also of West Indian distribution. For the stages of development in the microspheric and megalospheric forms, the reader is referred to part 6 of Bulletin 71 of the United States National Museum, where on pages 85 and 86, this development is discussed.

PENEROPLIS PERTUSUS (Forskål)

Plate 12, figures 3–6

Nautilus pertusus Forskål, Descr. Anim., 1775, p. 125, No. 65.

Peneroplis pertusus Jones, Parker, and H. B. Brady, Foram. Crag., 1865, p. 19.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 204, pl. 13, figs. 16, 17.—Cushman, Proc. U. S. National Mus., vol. 59, 1921, p. 75, pl. 18, figs. 7, 8; Publ. 311, Carnegie Instit. Washington, 1922, p. 78; Publ. 342, 1924, p. 71; Publ. 344, 1926, p. 83.

Peneroplis elegans d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 61, pl. 7, figs. 1, 2.

Test typically close coiled throughout, compressed, biumbilicate, coils not usually completely involute, the earlier coils showing at the umbilical region, periphery rounded to subacute; chambers numerous, very variable in number, distinct, not inflated, low and broad; sutures distinct, spiral suture depressed, other sutures often raised and somewhat limbate; wall ornamented with fine striae parallel to the periphery; aperture consisting of numerous pores along the middle line of the apertural face.

Size very variable.

[6] Peneroplis, Eine Studie zur biologischen Morphologie und zur Speciesfrage (Leipzig, 1898, pp. i–vi, 1–119 pls. 1–5 with figures 1–254, and text figs. A–Q).

In the West Indian region this species is the least common of all those recorded when actual material is studied. The d'Orbignyan species, *P. elegans*, seems to be identical with this species as commonly understood. He recorded it from Cuba and Jamaica. I have recorded it from Jamaica, Porto Rico, and the Tortugas, and it occurs at Habana. In the Indo-Pacific region and in the Mediterranean this species is often abundant.

Peneroplis pertusus—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
						° C.		
9958	J.A.C.	1		Habana Harbor, Cuba				Rare.
9964	J.A.C.	1		Biscayne Bay, Fla				Do.
10189	J.A.C.	1	23	Dry Tortugas, Fla	10		m. s	Do.
4818	J.A.C.	9	21	do	6		fne. s	Common.
4816	J.A.C.	1	12	do	7	23	s	Rare.
6184	J.A.C.	1		Habana Harbor, Cuba				Do.
4819	J.A.C.	5	6	San Juan Harbor, Porto Rico.			fne. s	Do.
4817	J.A.C.	11	22	Dry Tortugas, Fla	6			Abundant.

PENEROPLIS CARINATUS d'Orbigny

Plate 12, figures 7–10; Plate 14, figure 1

Peneroplis carinatus d'Orbigny, Voy. Amér. Mérid., vol. 5, pt. 5, 1839, "Foraminifères," p. 33, pl. 3, figs. 7, 8.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 205, pl. 13, fig. 14.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1925, p. 602.—Cushman, Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 482; Proc. U. S. Nat. Mus., vol. 59, 1921, p. 75, pl. 18, fig. 12; Publ. 311, Carnegie Inst. Washington, 1922, p. 79.—Heron-Allen and Earland, Journ. Linn. Soc. Zool., vol. 35, 1924, p. 610; Trans. Zool. Soc. London, vol. 22, 1926, p. 69, (list).

Peneroplis pertusus, var. *carinatus* Cushman, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 87, pl. 37, fig. 4.

Test close coiled, completely involute, periphery subacute; chambers 12 to 15 in the adult coil, low and broad, distinct; sutures distinct, depressed, not limbate; wall smooth, not striate; aperture a series of pores in the central portion and toward the base of the apertural face.

D'Orbigny's original locality was "not far from the mouth of the Rio Negro, Patagonia," where it was rare. Specimens from various regions have been referred to this species, but in the material I have had from the West Indian region, it is very rare and did not occur at all in the abundant Bermuda material I have had.

Peneroplis carinatus—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
4800	J.A.C.	16	22	Dry Tortugas, Fla	6		fne. s	Abundant.
4799	J.A.C.	32	23	do	10		m. s	Do.
4801	J.A.C.	2		Bogue Islands, Jamaica, West Indies.	[1] 2			Rare.
9956	J.A.C.	1		Habana Harbor, Cuba				Do.

[1] Feet.

PENEROPLIS PROTEUS d'Orbigny

Plate 13, figures 1–17

Peneroplis protea d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 60, pl. 7, figs. 7–11.

Peneroplis proteus Cushman, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 75, pl. 18, figs. 13–19; Publ. 311, Carnegie Instit. Washington, 1922, p. 79; Publ. 344, 1926, p. 83.

Peneroplis dubius d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 62, pl. 6, figs. 21, 22.

Orbiculina adunca H. B. Brady, (part), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 14, figs. 3, 4.

Test with the early portion close coiled and completely involute, thickened, later portion assuming various shapes and variously flaring but not becoming entirely embracing; chambers numerous, but not many, 10 to 12 usually in the coils of the early portion, usually somewhat higher than in most other species; sutures distinct, depressed; wall very smooth, thick, usually opaque; apertures formed by the row of pores along the median line of the apertural face.

Length, up to 1.5 mm.

This is by far the most common species of the genus in the warmer regions of the Western Atlantic. D'Orbigny had it from Cuba and Jamaica. I have had it from the north coast of Jamaica where it was common. It is abundant in the shallow water collections of the Tortugas, off Florida, and elsewhere off southern Florida north at least to Biscayne Bay. It is the most common species of the genus in Bermuda, the Bahamas, and Porto Rico, and probably is widely distributed in the general West Indian region. Brady's specimens referred to above are from off Pernambuco, Brazil, and are typical *P. proteus*. The *Albatross* obtained it in the same region.

Some of the variations of this very plastic species are shown on the plate and these could easily be much increased.

Peneroplis proteus—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
10381	J.A.C.	2	4	Dry Tortugas, Fla	1		c. o	Rare.
4857	J.A.C.	6	6	do	[1] 4–5		m	Few.
4843	J.A.C.	11	8	do	½		s	Abundant.
4853	J.A.C.	2	9	do	[2]	96 ° C.	s	Rare.
4847	J.A.C.	3	10	do	11	23.2	s	Do.
4855	J.A.C.	4	12	do	7	23	s	Do.
4862	J.A.C.	2	13	do	11		fne. s	Do.
4848	J.A.C.	6	14	do	12		fne. s	Few.
4849	J.A.C.	7	18	do	7		fne. s	Do.
4852	J.A.C.	4	19	do	5.75		fne. s	Rare.
4854	J.A.C.	4	20	do	7		fne. s	Do.
4856	J.A.C.	5	22	do	6		fne. s	Few.
4841	J.A.C.	10	23	do	10.5		m. s	Common.
4850	J.A.C.	2	24	do	3.5		c. s	Rare.
4844	J.A.C.	11	27	do	7		m. fne. s	Abundant.
4851	J.A.C.	7	28	do	4.75		fne. s	Few.
4842	J.A.C.	11	37	do	11		fne. s	Abundant.
4845	J.A.C.	5	42	do	18		s	Few.
			(Albatross)	° ′ ″ ° ′ ″		° F.		
20876	U.S.N.M.	1	D2358	28 00 15 N.; 87 42 00 W	1,467	51.2	yl. oz	Rare.
20877	U.S.N.M.	1	D2388	29 28 00 N.; 88 01 00 W	35		yl. s. bk. sp	Do.
20878	U.S.N.M.	2	D2388	29 28 00 N.; 88 01 00 W	35		yl. s. bk. sp	Do.
20879	U.S.N.M.	2	D2258	40 26 00 N.; 69 29 00 W	26	51.9	gy. s. bk. sp	Do.
20880	U.S.N.M.	6	D2758	6 59 30 S.; 34 47 00 W	20	79	brk. sh	Few.
10004	J.A.C.	6	5	Between Boaz Island, and Somerset, Bermuda.	3		s	Do.
9965	J.A.C.	7	4	do	2.5		s. m	Common.
9971	J.A.C.	5	3	do	6.5		s. m	Rare.
9983	J.A.C.	2	10	do	4.5		s	Few.
9989	J.A.C.	6	2	do	4.5		s. m	Common.
9990	J.A.C.	9	1	do	5		m. s	Do.
4911	J.A.C.	1		Great Bahama Bank				Rare.
4821	J.A.C.	3		do				Do.
9963	J.A.C.	3		South Bight, Lisbon Point, Bahamas.				Do.
4820	J.A.C.	4		Biscayne Bay, Fla				Do.
4815	J.A.C.	2		do				Do.
4876	J.A.C.	24		South Bight, Bahamas				Abundant.
6183	J.A.C.	6		Habana Harbor, Cuba				Few.
4860	J.A.C.	2	7	San Juan Harbor, Porto Rico.	2.5			Rare.
4858	J.A.C.	1	8	do	2		s	Do.
9972	J.A.C.	6	9	Mangrove Bay, Somerset, Bermuda.	6		crs. s	Few.
9975	J.A.C.	10	11	Somerset, Bermuda	1			Common.
9998	J.A.C.	9	7	Mangrove Bay, Somerset, Bermuda.	3		fne. s	Do.
9995	J.A.C.	1	1	do	5		m. s	Rare.
4859	J.A.C.	6	6	San Juan Harbor, Porto Rico.	1.5			Few.
9957	J.A.C.	18		Habana Harbor, Cuba				Abundant.
4822	J.A.C.	4		Nassau Harbor, Bahamas				Rare.
4861	J.A.C.	4		Montego Bay, Jamaica, West Indies.	10			Do.
4846	J.A.C.	9	21	Dry Tortugas, Fla	6		fne. s	Common.

[1] Feet.
[2] 6 feet 1 inch.

PENEROPLIS PLANATUS (Fichtel and Moll)

Plate 14, figures 6, 7

Nautilus (*Lituus*) *arietinus* Batsch (part), Conch. Secsandes, 1791, p. 4, pl. 6, figs. 15 *a*, *b*.

Nautilus planatus, var. *β*, Fichtel and Moll, Test. Micr., 1803, p. 91, pl. 16, figs. *d*, *e*, *f*.

Peneroplis lanatus Montfort, Conch. Syst., 1808, vol. 1, p. 258, 65e genre.

Peneroplis planatus d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 285, No. 1, Modéles, No. 16.—Williamson, Rec. Foram. Great Britain, 1858, p. 45, pl. 3, figs. 84, 85.—Schlumberger, Feuille Jeunes Nat., vol. 12, 1881, pl. 1, fig. 13.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 204, pl. 13, fig. 15.—Jones, Foram. Crag, pt. 2, 1895, p. 133, pl. 6, fig. 5.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 601.—Cushman, Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 481.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 22, 1926, p. 69, (list).

Peneroplis pertusus, var. *planatus* A. Silvestri, Atti Accad. Sci. Acireale, vol. 7, 1895–96, p. 42.—Dakin, Rept. Pearl Oyster. Fish., Ceylon, 1906, p. 231.—Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 124.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, No. 16, 1910, p. 7.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 87, pl. 37, fig. 3; Publ. 213, Carnegie Instit. Washington, 1918, p. 290.

Cristellaria planata Lamarck, Tableau Encycl. Meth., 1816, pl. 467, figs. 1 *a–c*.

Cristellaria dilatata Lamarck, Tableau Encycl. Meth., 1816, pl. 467, fig. 2 *a–c*.

Test much compressed, the early portion coiled planispirally but often partially evolute, later portion very much campanulate and spreading out, reaching back on both sides toward the earlier chambers but not entirely embracing; chambers distinct, very slightly inflated, broad and low; sutures distinct, depressed, occasionally somewhat limbate; wall very distinctly striate, the striae numerous and nearly parallel to the periphery; apertures along the median line of the narrow apertural face.

This species is abundant in the Mediterranean and in the Indo-Pacific, but does not, so far as I have seen, come into the West Indian region, where it is replaced by the following species. In the eastern Atlantic, what seem to be typical specimens are recorded from off the coast of Great Britain, and very likely the species like other Mediterranean ones extends out into the warmer parts of the eastern Atlantic.

PENEROPLIS BRADYI, new species

Plate 14, figures 8–10

Peneroplis planatus CUSHMAN, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 75, pl. 18, fig. 9 (not Fichtel and Moll); Publ. 311, Carnegie Instit. Washington, 1922, p. 79.

Peneroplis pertusus, var. *planatus* WOODWARD, The Observer, vol. 4, 1893, p. 77.

Test small, very greatly compressed, early portion planispirally coiled, usually partially evolute, later portion broadening, forming a flaring test; chambers distinct, long and low; sutures very distinct, depressed; wall finely pitted but not striate; apertures in the central line of the apertural face.

Length, usually less than 1 mm., often much less.

Holotype.—(Cushman Coll. No. 4840), from Montego Bay, Jamaica.

This species is next to *P. proteus* the most common in the West Indian region. It occurs at numerous stations off the Tortugas and the Florida Keys, at Bermuda and Jamaica. It is probably widely distributed in the general West Indian region.

Peneroplis planatus, so far as I have seen, does not occur in the western Atlantic and is apparently replaced by this species.

Karrer described a variety of *P. planatus* as var. *laevigata* from the Miocene of Kostej, but it is not the same as the West Indian species. I have topotypes of Karrer's variety for comparison. Brady's specimens, figured under this varietal name,[7] are from Bermuda and probably are *P. bradyi*.

Peneroplis bradyi—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
						°F.		
20864	U.S.N.M.	4	D2758	6° 59′ 30″ S.; 34° 47′ W	20	79	brk, sh	Rare.
9955	J.A.C.	1		Habana Harbor, Cuba		23	s	Do.
4838	J.A.C.	2	12	Dry Tortugas, Fla	7		fne. s	Do.
10379	J.A.C.	1	13	do	11		fne. s	Do.
4839	J.A.C.	2	14	do	12		fne. s	Do.
4835	J.A.C.	8	20	do	7		fne. s	Common.
4833	J.A.C.	6	22	do	6		fne. s	Few.
4828	J.A.C.	5	22	do	6		fne. s	Do.
10380	J.A.C.	1	23	do	10.5		m. s	Rare.
4832	J.A.C.	7	27	do	7		m. fne. s	Few.
4829	J.A.C.	2	28	do	4.75		fne. s	Rare.
4830	J.A.C.	3	37	do	11		fne. s	Do.
4831	J.A.C.	2	42	do	18		s	Do.
4836	J.A.C.	8	21	do	6		fne. s	Common.
4840	J.A.C.	3		Montego Bay, Jamaica, West Indies.	6			Rare.

[7] Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 13, figs. 12, 13

PENEROPLIS DISCOIDEUS Flint

Plate 15, figures 6–8

Peneroplis pertusus (Forskål), var. *discoideus* Flint, Rep. U. S. Nat. Mus., 1897, (1899), p. 304, pl. 49, figs. 1, 2.—Cushman, Publ. 291, Carnegie Instit. Washington, 1919, p. 69.

Peneroplis discoideus Cushman, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 76, pl. 18, fig. 20; pl. 19, figs. 1–3; 13th Ann. Rep't Florida Geol. Survey, 1921, p. 63; Publ. 311, Carnegie Instit. Washington, 1922, p. 80.

Test much compressed, in the young close coiled and involute, the chambers later becoming elongate, finally spreading out and embracing the earlier portion of the test, forming in the adult completely annular chambers; sutures distinct, depressed; wall entirely smooth; aperture in the adult formed by pores about the median line of the periphery.

Diameter, up to 2.25 mm.

Flint described this species from shallow water of Key West Harbor, Fla. I collected very typical specimens at this same locality, at the Tortugas, off Jamaica and at Bermuda. It also occurs in the Bahamas and probably has a very wide general West Indian distribution. It occurs also in the Late Tertiary of Cercado de Mao, Santo Domingo, and in wells of southern Florida.

There are no records of its occurrence in the Pacific, and like *P. proteus* is probably a species of the western tropical Atlantic.

It may be easily confused with *Sorites compressa* (d'Orbigny), which may have developed from it. The *Peneroplis*, however, does not have its chambers divided into chamberlets, a character easily brought out by moistening the test.

Peneroplis discoideus—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
				° ′ ″ ° ′ ″		°F.		
20865	U.S.N.M.	3	D2358	20 19 00 N.; 87 03 30 W.	222		fne. w. h. co.	Rare.
20866	U.S.N.M.	1	D2388	20 24 30 N.; 88 01 00 W.	35		yl. s. bk. sp.	Do.
20867	U.S.N.M.	4	D2758	6 59 30 S.; 34 47 00 W.	20	79	brk. sh.	Do.
9968	J.A.C.	5	4	Mangrove Bay, Somerset, Bermuda.	2.5		s. m.	Few.
9994	J.A.C.	7	1	do	5		s. m.	Do.
9988	J.A.C.	3	2	do	4.5		s.	Rare.
9976	J.A.C.	5	11	do	1		crs. s.	Common.
4810	J.A.C.	1		Great Bahama Bank				Rare.
4809	J.A.C.	1		Montego Bay, Jamaica, West Indies.	6			Do.
4807	J.A.C.	4		Dry Tortugas, Fla.			fne. s.	Do.
4806	J.A.C.	5	18	do	7		fne. s.	Few.
10373	J.A.C.	1	18	do	7		fne. s.	Rare.
4837	J.A.C.	2	30	do	2		s.	Few.
4808	J.A.C.	7	37	do	11		fne. s.	Do.
4805	J.A.C.	3	42	do	18		s.	Rare.

Genus DENDRITINA d'Orbigny, 1826

Dendritina d'Orbigny, Ann. Sci. Nat., vol 7, 1826, p. 285.—Cushman. Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 217.
Peneroplis (part) of Authors.

Genotype, by designation.—*Dendritina arbuscula* d'Orbigny.

Test similar to *Peneroplis*, the test usually thick and showing a tendency to uncoil; aperture dendritic, in the apertural face.

Eocene to Recent.

The species of this genus are very highly developed in the Eocene, but a few are found in the present oceans, especially in the Indo-Pacific region. I have not found any Atlantic species belonging to this genus.

DENDRITINA ANTILLARUM d'Orbigny

Plate 14, figures 2–5

Dendritina antillarum d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 285, No. 3; in De la Sagra, Hist. Fis. Pol. Nat. Hist., Cuba, 1839, "Foraminifères," p. 58, pl. 7, figs. 3–6.
Peneroplis pulchellum d'Orbigny, Voy. Amér. Mérid., 1839, vol. 5, pt. 5, "Foraminifères," p. 32, pl. 3, figs. 5, 6.

This species described by d'Orbigny from the West Indies has occurred in material from Bermuda.

Genus SPIROLINA Lamarck, 1804

Spirolina Lamarck, Ann. Mus., vol 5, 1804, p. 244.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 217.
Peneroplis (part) of Authors.

Genotype, by designation.—*Spirolina cylindracea* Lamarck.

Test similar to *Peneroplis*, thick; early chambers close coiled, usually not completely involute, later ones uncoiled; aperture rounded terminal.

Cretaceous (?) to Recent.

This genus is especially well developed in the Upper and Middle Eocene, but occurs also Recent, especially in warm, shallow waters of the Indo-Pacific. There are but two species, so far as the material examined shows, in the western tropical Atlantic, and these are very rare.

SPIROLINA ACICULARIS (Batsch)

Plate 15, figures 1–3

Nautilus (*Lituus*) *acicularis* Batsch, Conch. Seesandes, 1791, p. 4, pl. 6, fig. 16*a*, *b*.

Test with the earliest chambers close coiled but making only a small portion of the test which in the adult is cylindrical or very slightly tapering, circular in transverse section the chambers becoming as high as broad; sutures distinct, slightly depressed; wall longitudinally striate, translucent, thin; aperture consisting of one or more pores in the middle of the terminal face.

Length of western Atlantic specimens not over 0.50 mm.

This form has usually been referred to Lamarck's "*P. cylindracea*" based on Eocene specimens from France. An examination of the French specimens shows that Lamarck's species is thicker and heavier, and the wall has distinct, sharply raised costae, altogether different from the species that occurs in the present ocean, at least in the western Atlantic. These specimens which are very rare from Jamaica and the Tortugas are referred to Batsch's recent species, the types of which are from the Mediterranean.

A comparison of other recent material referred to Lamarck's species should be made with Eocene material from the type locality.

Spirolina acicularis—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
10302	J.A.C.	2	----------	San Juan Harbor, Porto Rico.	*Feet* 15	-------	----------	Rare.

SPIROLINA ARIETINUS (Batsch)

Plate 15, figures 4, 5

Nautilus (*Lituus*) *arietinus* Batsch (part), Conch. Seesandes, 1791, p. 4, pl. 6, fig. 15*c*.

Peneroplis arietinus Parker, Jones, and H. B. Brady, Ann. Mag. Nat. Hist., ser. 3, vol. 16, 1865, p. 26, pl. 1, fig. 18.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 204, pl. 13, figs. 18, 19, 22.—Chapman, Journ. Linn. Soc. Zool., vol. 28, 1900, pp. 149, 207, (list), 400 (list).—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 602.—Cushman, 13th Ann. Rep't Florida Geol. Survey, 1921, p. 62; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 482; Proc. U. S. Nat. Mus., vol. 59, 1921, p. 75, pl. 18, fig. 10.—Heron-Allen and Earland, Bull. Soc. Sci. Hist. Nat. Corse, 1922, p. 125.—Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 79.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 22, 1926, p. 69 (list).

Peneroplis pertusus, var. *arietinus* Woodward, The Observer, vol. 4, 1893, p. 77.—A. Silvestri, Atti Accad. Sci. Acireale, vol. 7, 1895–96, p. 42.—Dakin, Rep't Pearl Oyster Fish. Ceylon, 1906, p. 231.—Heron-Allen and Earland, Journ. Roy Micr. Soc., 1909, p. 319.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, No. 16, 1910, p. 7.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 88, pl. 36, fig. 2; pl. 37, fig. 5; Publ. 213, Carnegie Instit. Washington, 1918, p. 290.

Test in the early portion close coiled but not completely involute, somewhat compressed, later portion uncoiling and the chambers broadly elliptical in transverse section; chambers distinct, the later ones slightly inflated; sutures distinct, earlier ones often slightly raised, somewhat limbate, later ones narrow and slightly depressed;

wall longitudinally striate; aperture consisting of a series of independent pores in the central portion of the apertural face.

This species, often abundant in the Mediterranean and Indo-Pacific, is very rare in the western tropical Atlantic. Woodward records it from Bermuda, and I collected it there also, but it was very rare. It occurs at the Tortugas, but there also it is very rare. I found it rare also at Montego Bay, Jamaica.

This is evidently a widely distributed form occurring but in small numbers in the general West Indian region.

Spirolina arietinus—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
20875	U.S.N.M.	1	D2388	29° 24′ 30″ N.; 88° 01′ 00″ W.	35		yl. s. bk. sp.	Rare.
9999	J.A.C.	2	7	Mangrove Bay, Somerset, Bermuda.	3		fne. s	Do.
4796	J.A.C.	1	14	Dry Tortugas, Fla	12		fne. s	Do.
4802	J.A.C.	3	21	do	6		fne. s	Do.
4803	J.A.C.	1	22	do	6		fne. s	Do.

Genus MONALYSIDIUM Chapman, 1900

Monalysidium Chapman, Journ. Linn. Soc. Zool., vol. 28, 1900, p. 3 (as a subgenius of *Peneroplis*).—Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 80; Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 218.

Genotype, by designation.—*Monalysidium sollasi* Chapman.

Test with the early chambers close coiled, later ones uncoiled in a rectilinear series; wall imperforate, smooth or with vertical rows of minute tubercles; aperture circular, terminal, sometimes with a short neck and lip.

Recent.

The early chambers of specimens are easily broken, and it is usual to find only the uniserial chambers present after samples are washed. The constrictions at the sutures leave the test very weak. The neck and lip that are developed are similar to those seen in so many of the uncoiled genera of various families of the foraminifera.

MONALYSIDIUM POLITUM Chapman (?)

Plate 15, figures 11, 12

Peneroplis lituus H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 205, pl. 13, figs. 24, 25 (?).

Peneroplis (*Monalysidium*) *polita* Chapman, Journ. Linn. Soc. London, Zool., vol. 28, 1902, p. 4, pl. 1, fig. 5 (?).

Monalysidium polita Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 603, text fig. 43 G.—Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 80, pl. 13, fig. 4; Publ. 344, 1926, p. 84.

So little is known of this genus that it is difficult to specifically place specimens. Brady's specimens figured in the *Challenger* Report are from the Cape Verde Islands. Chapman's figures seem to be different in shape and surface characters from those of Brady and from those found at the Tortugas and Porto Rico. The specimens from the West Indian region are all of the same species, but consist of a rectilinear series only, and all appear to be broken. One specimen shows two tubular orifices at one end instead of one as is usual. Specimens were rare at all stations. I did not find it at Bermuda.

Monalysidium politum—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
10307	J.A.C.	2	7	San Juan Harbor, Porto Rico.	2.5			Rare.
4863	J.A.C.	1	7	do	2.5			Do.
4865	J.A.C.	1	28	Dry Tortugas, Fla	4.75		fne. s	Do.
4866	J.A.C.	1	27	do	7		m. fne. s	Do.
4867	J.A.C.	2	22	do	6		fne. s	Do.
4868	J.A.C.	1	21	do	6		fne. s	Do.

Subfamily 2. ARCHAIASINAE

Test discoid, the early chambers spiral and simple, later ones divided into chamberlets, later stages variously involute.

Genus FALLOTIA H. Douvillé, 1902

Fallotia H. DOUVILLÉ, Bull. Soc. Géol. France, ser. 4, vol. 2, 1902, p. 298.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 218.

Genoholotype.—Fallotia jacquoti H. Douvillé.

Test discoid, nummulitoid throughout the growth, the growing edge always peripheral; chambers involute, V-shaped, divided into chamberlets.

Upper Cretaceous.

Genus MEANDROPSINA Munier-Chalmas, 1899

Meandropsina MUNIER-CHALMAS, in Schlumberger, Bull. Soc. Géol. France, ser. 3, vol. 27, 1899, p. 336.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 220.

Genoholotype.—Meandropsina vidali Schlumberger.

Test discoid, the growing edge variously meandering over the flattened faces of the test; chambers with many chamberlets; apertures rounded, in linear rows.

Upper Cretaceous.

Genus ARCHAIAS Montfort, 1808

Archaias Montfort, Conch. Syst., vol. 1, 1808, p. 191.—Cushman, Special Publ. No. 1. Cushman Lab. Foram. Res., 1928, p. 220.

Helenis Montfort, Conch. Syst., vol. 1, 1808, p. 195 (genoholotype, *Helenis spatosus* Montfort=*Nautilus aduncus* Fichtel and Moll).

Ilotes Montfort, Conch. Syst., vol. 1, 1808, p. 199 (genoholotype, *Ilotes rotalitatus* Montfort=*Nautilus orbiculus* Fichtel and Moll).

Orbiculina Lamarck, Ency. Méthod., pt. 23, 1816, p. 468 (genotype, by designation, *Nautilus aduncus* Fichtel and Moll).

Genoholotype.—*Archaias spirans* Montfort=*Nautilus angulatus* Fichtel and Moll.

Test in the early stages planispiral and lenticular, bilaterally symmetrical, in later stages becoming flaring, even annular; wall imperforate except in the very earliest chambers which are perforate, divided into chamberlets; apertures in several rows on the apertural face.

Miocene to Recent.

ARCHAIAS ANGULATUS (Fichtel and Moll)

Plate 16, figures 1–3; plate 17, figures 3–5

Nautilus angulatus Fichtel and Moll, Test. Micr., 1803, p. 112, pl. 21.

Archaias angulatus Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 218, pl. 31, fig. 9.

Orbiculina angulata Lamarck, Anim. sans Vert., vol. 7, 1822, p. 609, No. 2.

Archaias spirans Montfort. Conch. Syst., vol. 1, 1808, p. 190, 48e genre.

Nautilus aduncus Fichtel and Moll, Test Micr., 1803, p. 115, pl. 23.

Orbiculina adunca Lamarck, Tabl. Encycl. Méth., 1816, pl. 468, figs. 2*a–c*.—d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères", p. 81, pl. 8, figs. 8–14 (and later authors).

Nautilus orbicularis Fichtel and Moll, Test. Micr., 1803, p. 112, pl. 21.

Helenis spatosus Montfort, Conch. Syst., vol. 1, 1808, p. 195, 49e genre. (=*Nautilus aduncus* Fichtel and Moll).

Ilotes rotalitatus Montfort, Conch. Syst., vol. 1, 1808, p. 199, 50e genre. (=*Nautilus orbiculus* Fichtel and Moll).

Orbiculina numismalis Lamarck, Hist. Anim. sans Vert., vol. 7, 1822, p. 609.—Defrance, Dict. Sci. Nat., vol. 32, 1824, p. 180; vol. 36, 1825, p. 291; Atlas Conch., pl. 15, fig. 4 (and later authors).

Test much compressed, the early portion close coiled, later becoming more or less complanate or even circular, periphery truncate; early chambers simple, later ones divided into a series of chamberlets by partitions generally at right angles to the periphery, distinct, elongate, low; sutures distinct, depressed; wall imperforate, milky-white, with numerous shallow punctations of the surface but not forming perforations, in the earliest chambers, the proloculum and immediately following chamber, perforate; aperture in the early stages, as in *Peneroplis*, a narrow slit, then a series of pores, one to each chamberlet, in a slight depression in the median line of the peripheral face.

Miocene to Recent.

This species is very abundant in the West Indian region, and very much less so in the Indo-Pacific. In the western tropical Atlantic, it is often the dominant species in comparatively shallow water.

The original specimens of Fichtel and Moll are recorded from the Mediterranean and the Arabian Sea. There is much question as to its occurrence in the Mediterranean, and it may be that the authors had West Indian material from some source. The material from the Red Sea that I was able to see in the Brady collection has certain characters that seem to distinguish it from West Indian specimens. In the western Atlantic there may be two living species in addition to that often referred to as *Orbiculina compressa* d'Orbigny which is here included under *Archaias*. These species should all be studied in detailed section and the relationships of the microspheric and megalospheric forms determined. The species occurs fossil in the West Indies, Panama, and Florida.

Archaias angulatus—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
				° ′ ″ ° ′ ″				
20870	U.S.N.M.	10	D2758	28 21 00 N., 78 33 00 W	514	44.7	fne. brk. sh.	Common.
20871	U.S.N.M.	6	D2358	20 19 00 N., 87 03 30 W	222		fne. wh. co	Few.
20872	U.S.N.M.	3	D2388	29 24 30 N., 88 01 00 W	32		yl. s. bk. sp.	Rare.
9986	J.A.C.	4	2	Mangrove Bay, Somerset, Bermuda.	4.5		s	Few.
9977	J.A.C.	4	11	do	1		crs. s	Rare.
9974	J.A.C.	3	9	do	6		s	Do.
9969	J.A.C.	3	3	do	1		s	Do.
9966	J.A.C.	8	4	do	2.5		m.s	Common.
9993	J.A.C.	12	1	do	5		m. s	Abundant.
10003	J.A.C.	7	5	do	3		s	Few.
10001	J.A.C.	6	7	do	5		fne. s	Do.
9979	J.A.C.	6	13	do	4		bl. m	Do.
9982	J.A.C.	6	12	do	4		s. m	Do.
9985	J.A.C.	6	10	do	6.5		crs. s	Do.
9960	J.A.C.	12		Habana Harbor, Cuba				Abundant.
6182	J.A.C.	5		do				Few.
4870	J.A.C.	22	6	San Juan Harbor, Porto Rico.	1.5			Abundant.
10303	J.A.C.	3	7	do	2.5			Rare.
4869	J.A.C.	26	8	do	2.5			Abundant.
4871	J.A.C.	13	7	do	2			Do.
4872	J.A.C.	7		Nassau Harbor, Bahamas				Few.
4873	J.A.C.	19		Biscayne Bay, Fla				Abundant.
4874	J.A.C.	17		South Bight, Andros, Bahamas.				Do.
4875	J.A.C.	16		Biscayne Bay, Fla				Do.
4877	J.A.C.	6		South Bight, Andros, Bahamas.				Few.
4878	J.A.C.	4		Great Bahama Bank				Rare.
4879	J.A.C.	5		Biscayne Bay, Fla				Few.
4880	J.A.C.	4		Great Bahama Bank				Rare.
4881	J.A.C.	3		Montego Bay, Jamaica, West Indies.				Do.
4886	J.A.C.	14	9	Dry Tortugas, Fla	⅛	96	s	Abundant.
4889	J.A.C.	16	18	do	7		fne. s	Common.
4890	J.A.C.	10	19	do	5.75		fne. s	Do.
4891	J.A.C.	17	4	do	1		c. s	Abundant.
4892	J.A.C.	18	6	do	⅔		m	Do.
4893	J.A.C.	22	8	do	½		s	Do.
4894	J.A.C.	15	14	do	12		fne. s	Do.
						° C.		
4897	J.A.C.	5	12	do	7	23	s	Few.
4898	J.A.C.	11	10	do	11	23.2	s	Common.
4900	J.A.C.	2	13	do	11		fne. s	Rare.
4901	J.A.C.	12	24	do	3.5		crs. s	Abundant.
4902	J.A.C.	8	28	do	4.75		fne. s	Common.
4882	J.A.C.	15	37	do	11		fne. s	Abundant.
4883	J.A.C.	9	23	do	10.5		m. s	Common.
4884	J.A.C.	9	21	do	6		fne. s	Do.
4885	J.A.C.	4	20	do	7		fne. s	Rare.
4887	J.A.C.	18	30	do	2		s	Abundant.
4888	J.A.C.	8	22	do	6		fne. s	Common.
4896	J.A.C.	9	42	do	18		s	Do.
4899	J.A.C.	10	27	do	7		m. fne. s	Do.

ARCHAIAS COMPRESSUS (d'Orbigny)

Plate 17, figures 1, 2

Orbiculina compressa d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères," p. 73, pl. 8, figs. 4–7.—Cushman, Proc. U. S. Nat. Mus., vol. 59, 1919, p. 76, pl. 19, figs. 4–6; Publ. 291, Carnegie Instit. Washington, 1919, p. 70, pl. 7, fig. 6; Publ. 311, 1922, p. 81; Publ. 344, 1926, p. 84.

Test circular in outline, the early portion with several layers of chamberlets and the chambers much thicker than in later growth which is annular and the chamberlets in a single or double layer, greatest thickness of the test formed by the earlier involute portion; wall calcareous, imperforate, except in the proloculum and second chamber; aperture in the adult formed by a marginal row of pores, either single or double.

Diameter up to 2.50 mm.

The original material described by d'Orbigny came from the West Indies and was recorded as rare in Cuba, more common at Guadeloupe and St. Thomas, but abundant in Jamaica. It has occurred fossil in the Late Tertiary of Jamaica, Florida, and Panama.

It is not the same as *Sorites marginalis* Lamarck and can be distinguished from that species especially by the thickening of the earlier portion. A discussion of this species has already been given [8] with the early stages in development.

This species has often been included with *Archaias angulatus* but the two are distinct. *A. angulatus*, as shown in the figures of that species, does not become completely annular and is a much thicker, heavier species.

Archaias compressus—Material examined

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
						° C.		
4908	J.A.C.	5	----------	Montego Bay, Jamaica, West Indies.	10	-------	----------	Few.
4909	J.A.C.	1	----------	Biscayne Bay, Fla	-------	-------	----------	Rare.
4910	J.A.C.	4	----------	Nassau Harbor, Bahamas.	-------	-------	----------	Do.
9984	J.A.C.	2	11-------	Mangrove Bay, Somerset, Bermuda.	6.5	-------	s----------	Do.
9980	J.A.C.	6	12-------	-----do----------	4	-------	s----------	Few.
9992	J.A.C.	5	1--------	-----do----------	5	-------	m. s-------	Do.
9978	J.A.C.	4	13-------	-----do----------	4	-------	bl. m-------	Do.
9967	J.A.C.	3	4--------	-----do----------	2.5	-------	s. m-------	Rare.
9987	J.A.C.	10	2--------	-----do----------	4.5	-------	s----------	Common.
10000	J.A.C.	1	7--------	-----do----------	3	-------	fne. s-------	Rare.
9970	J.A.C.	12	3--------	-----do----------	1	-------	s----------	Abundant.
4919	J.A.C.	14	10-------	Dry Tortugas, Fla------	11	23.2	s----------	Do.
10375	J.A.C.	1	10-------	-----do----------	11	23.2	s----------	Rare.
4923	J.A.C.	11	12-------	-----do----------	7	23	s----------	Common.
4926	J.A.C.	1	13-------	-----do----------	11	-------	fne. s-------	Rare.
4920	J.A.C.	2	18-------	-----do----------	7	-------	----------	Do.
10376	J.A.C.	1	23-------	-----do----------	10.5	-------	m. s-------	Do.
10874	J.A.C.	2	37-------	-----do----------	11	-------	fne. s-------	Do.
4912	J.A.C.	13	37-------	-----do----------	11	-------	----------	Abundant.
4895	J.A.C.	8	42-------	-----do----------	18	-------	s----------	Common.

[8] Bull. 71, U. S. Nat. Mus., pt. 6, pp. 1917, 89–91.

Subfamily 3. ORBITOLITINAE

Test in the early stages planispiral, at least in the microspheric form, later annular, in the simplest forms the chambers only partially divided, completely so in the more complex forms; apertures on the peripheral face.

Genus PRAESORITES H. Douvillé, 1902

Praesorites H. DOUVILLÉ, Bull. Soc. Géol. France, ser. 4, vol. 2, 1902, p. 291.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 221.

Genoholotype.—Praesorites moureti H. Douvillé.

Test in the early stages planispiral, at least in the microspheric form later annular; chambers in a single plane, not completely divided into chamberlets; apertures numerous.

Cretaceous.

Genus SORITES Ehrenberg, 1838

Sorites EHRENBERG, Abhandl. k. Akad. Wiss. Berlin, 1838, p. 134.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 221.
Orbitolites (part), of AUTHORS (not Lamarck).

Genotype, by designation.—*Sorites dominicensis* Ehrenberg.

Test discoid, planispiral in the early stages at least of the microspheric form, later annular, completely divided into chamberlets; typically in a single layer, those of each annular chamber communicating with the adjacent ones as with those of the preceding and succeeding annular chambers; wall imperforate except in the very earliest chambers; apertures in a single line along the periphery.

Miocene to Recent.

Taramellina Munier-Chalmas is probably a synonym of *Sorites.*

Under this genus are included those species which have a single layer of annular chambers divided into chamberlets in the adult often referred to "*Orbiculina*" and "*Orbitolites.*"

SORITES MARGINALIS (Lamarck)

Plate 18, figures 1–4

Orbulites marginalis LAMARCK, Syst. Anim. sans Vert., vol. 2, 1816, p. 196, No. 1.
Orbitolites marginalis W. B. CARPENTER, Phil. Trans., vol. 174, 1883, p. 560, fig. 1; Rep. Voy. *Challenger,* "Orbitolites," 1883, p. 20, pl. 3, figs. 1–7; pl. 4, figs. 1–5.—H. B. BRADY, Rep. Voy. *Challenger,* Zoology, vol. 9, 1884, p. 214, pl. 15, figs. 1–5.—FLINT, Ann. Rep't U. S. Nat. Mus., 1897 (1899), p. 304, pl. 50, fig. 2; pl. 51, fig. 1.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 92, pl. 38, figs. 1, 2, text fig. 47.

Test thin, much compressed, circular in outline in the adult, the whole test composed of a single layer of chambers, each with a single layer of chamberlets throughout, early chambers in a spiral, later

extending back, finally meeting and in most of the chambers forming annuli; aperture consisting of a single row of pores along the periphery of the test.

Diameter, up to 2.5 mm.

This species is common at some localities, and in early life is an attached form afterwards becoming free. The development has already been discussed in part 6 of Bulletin 71.

Sorites marginalis—*Material examined*

Cat. No.	Collection of—	Number of specimens	Station	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
4903	J.A.C.	25	7	San Juan Harbor, Porto Rico.	2.5			Abundant.
4904	J.A.C.	3	4	do	2			Rare.
4905	J.A.C.	1	9	Shallow water, Ponce, Porto Rico.	1			Do.
4906	J.A.C.	4	8	San Juan Harbor, Porto Rico.	2			Do.
4907	J.A.C.	14	6	do	1.5			Abundant.
4913	J.A.C.	16	20	Dry Tortugas, Fla	7		fne. s	Do.
4914	J.A.C.	11	22	do	6		fne. s	Do.
4915	J.A.C.	16	23	do	10.5		m. s	Do.
4916	J.A.C.	12		do				Do.
4917	J.A.C.	10	27	do	7		m. fne. s	Do.
4918	J.A.C.	14	14	do	12		fne. s	Do.
4921	J.A.C.	12	18	do	7		fne. s	Do.
4922	J.A.C.	21	21	do	6		fne. s	Do.
4924	J.A.C.	24	19	do	5.75		fne. s	Do.
4925	J.A.C.	1	42	do	18		s	Rare.
4927	J.A.C.	1	30	do	2		s	Do.
10377	J.A.C.	3	9	do	1/6	96	s	Do.
4963	J.A.C.	2		Biscayne Bay, Fla				Do.
4964	J.A.C.	3		do				Do.
9959	J.A.C.	1		Habana Harbor, Cuba				Do.

Genus AMPHISORUS Ehrenberg, 1838

Amphisorus Ehrenberg, Abhandl. k. Akad. Wiss. Berlin, 1838, p. 130.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 221.
Orbitolites (part) of Authors, (not Lamarck).

Genoholotype.—*Amphisorus hemprichii* Ehrenberg.

Test discoid, planispiral in the early stages, at least of the microspheric form, later annular, completely divided into chamberlets; typically in two layers, those of each annular chamber communicating with the adjacent ones of the preceding and succeeding annular chambers and those of the two layers communicating; wall imperforate except in the very earliest chambers; apertures in a double, alternating line along the periphery.

Miocene to Recent.

Bradyella Munier-Chalmas is probably a synonym of *Amphisorus*.

AMPHISORUS HEMPRICHII Ehrenberg

Plate 18, figures 5–7

Amphisorus hemprichii Ehrenberg, Abhandl. k. Akad. Wiss. Berlin, 1838, p. 134, pl. 3, fig. 3.

"*Orbitolites*, duplex type," W. B. Carpenter, Philos. Trans., 1856, p. 120, pl. 5, fig. 10; pl. 9. fig. 10.

Orbitolites duplex W. B. Carpenter, Rep. Voy. *Challenger*, Zoology, pt. 21, 1883, p. 25, pl. 3, figs. 8–14; pl. 4, figs. 6–10; pl. 5, figs. 1–13.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 216, pl. 16, fig. 7.—W. B. Carpenter, Journ. Quekett Micr. Club, ser. 2, vol. 2, 1885, p. 97, fig. 9 in text.—Woodward, The Observer, vol. 4, 1893, p. 77.—Flint, Ann. Rep't U. S. Nat. Mus., 1897 (1899), p. 305, pl. 51, figs. 2, 3.—Chapman, Journ. Linn. Soc. London, Zool., vol. 28, 1902, p. 400 (list).—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 48, No. 5, 1904, p. 23.—Dakin, Rep. Pearl Oyster Fish. Ceylon, 1906, p. 232.—Rhumbler, Zool. Jahrb., Abt. Syst., vol. 24, 1906, p. 53.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, No. 16, 1910, p. 7.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 605.—Cushman, Bull. 71. U. S. Nat. Mus., pt. 6, 1917, p. 94, pl. 38, figs. 3, 4; pl. 39, fig. 1; Publ. 213, Carnegie Instit. Washington, 1918, p. 290; Proc. U. S. Nat. Mus., vol. 59, 1919, p. 77; Publ. 291, 1919, p. 70, pl. 5, figs. 9, 10; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 485.—Heron-Allen and Earland, Bull. Soc. Sci. Hist. Nat. Corse, 1922, p. 125.—Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 81; Publ. 342, 1924, p. 71.—Heron-Allen and Earland, Journ. Linn. Soc. London, Zool., vol. 35, 1924, p. 610.—Cushman, Publ. 344, Carnegie Instit. Washington, 1926, p. 84.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 22, 1926, p. 69 (list).

Test much compressed, circular in outline, the early chambers in the microspheric form coiled planispirally, soon widening and becoming annular, in the megalospheric form the annular chambers beginning at once after the large rounded or oval proloculum; chambers in two layers in the adult, and each divided into many chamberlets, the chamberlets of each newly added series alternating with those of the preceding series; wall imperforate except in the proloculum and succeeding chamber which are finely porous; apertures at the periphery of the chamberlets in a double series as are the chamberlets.

Diameter, up to 2 mm.

The species, if those of the West Indian region and those of the Indo-Pacific and Mediterranean are the same, has a wide distribution. In the West Indies it occurs in great numbers attached to the leaves of the short eel-grass, *Posidonia*, which grows in great profusion in shallow water.

I have examined the types of *Amphisorus hemprichii* in the Ehrenberg collection in Berlin, and it seems that Carpenter's species is a synonym in which case Ehrenberg's name will take precedence.

Specimens were found in Jamaica which had megalospheric young in the outer chambers of the parent test.

Amphisorus hemprichii—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
				° ′ ″ ° ′ ″				
20874	U.S.N.M.	1	D2388	29 24 30 N., 88 01 00 W	35		yl. s. bk. sp.	Rare.
20873	U.S.N.M.	1	D2758	6 59 30 N., 34 47 00 W	20	79	brk. sh.	Do.
9997	J.A.C.	4	7	Mangrove Bay, Somerset, Bermuda.	3		fne. s.	Do.
9973	J.A.C.	5	9	do	6		s.	Few.
10378	J.A.C.	1	10	do	6.5		s.	Rare.
9981	J.A.C.	3	12	do	4		s.	Do.
6191	J.A.C.	3		Habana Harbor, Cuba				Do.
4952	J.A.C.	1	4	San Juan Harbor, Porto Rico.	1			Do.
4953	J.A.C.	1	7	do	2.5			Do.
4954	J.A.C.	5		Runaway Bay, Jamaica, West Indies.				Few.
4938	J.A.C.	2	8	Dry Tortugas, Fla	½		s.	Rare.
4939	J.A.C.	16	6	do	⅔		m.	Abundant.
4940	J.A.C.	2	10	do	11	23.2 C.	s.	Rare.
4941	J.A.C.	3	9	do	⅛	96	s.	Do.
4942	J.A.C.	1	13	do	11		fne. s.	Do.
4943	J.A.C.	1	12	do	7	23 C.	s.	Do.
4944	J.A.C.	8	14	do	12		fne. s.	Common.
4945	J.A.C.	3	18	do	7		fne. s.	Rare.
4947	J.A.C.	1	20	do	7		fne. s.	Do.
4950	J.A.C.	8	19	do	5.75		fne. s.	Common.
4951	J.A.C.	9	27	do	7		m. fne. s.	Do.
4937	J.A.C.	1	30	do	2		s.	Rare.
4946	J.A.C.	12	22	do	6		fne. s.	Abundant.
4948	J.A.C.	11	28	do	4.75		fne. s.	Do.
4949	J.A.C.	25	21	do	6		fne. s.	Do.

Genus MARGINOPORA Quoy and Gaymard, 1834

Marginopora Quoy and Gaymard, Voyage de L'Astrolabe, 1833 according to Blainville, Man. Actin., 1834, p. 412.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 222.

Orbitolites (part) of Authors (not Lamarck).

Genoholotype.—*Marginopora vertebralis* Quoy and Gaymard.

Test in the early stages similar to *Sorites* with one or two rows of apertures, later with the two original planes of chambers forced apart and filled with a high series of chamberlets, those adjacent in each annular chamber connecting, the outer wall projecting beyond the peripheral plane of the lateral chambers; the apertures in more or less vertical rows on the periphery with a horizontal row above and below.

Recent. Indo-Pacific.

Genus ORBITOLITES Lamarck, 1801

Orbitolites Lamarck, Syst. Anim. sans Vert., 1801, p. 376.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 222.

Discolites (?) Montfort, Conch. Syst., vol. 1, 1808, p. 187 (genoholotype, *Discolites concentricus* Montfort).

Orbulites Lamarck, Extrait Cours Zool., 1812, p. 26 (genoholotype, *Orbitolites complanata* Lamarck).

Genotype, by designation.—*Orbitolites complanata* Lamarck.

Test discoidal, the earliest chambers in the microspheric form coiled, later annular, divided into chamberlets, those of the same

annular chamber not connecting with each other but with those of the adjacent preceding and succeeding annular chambers; wall imperforate except in the very earliest chambers which are perforate; apertures numerous, rounded on the periphery of the test.

Eocene.

Genus OPERTORBITOLITES Nuttall, 1925

Opertorbitolites NUTTALL, Quart. Journ. Geol. Soc., vol. 81, 1925, p. 447.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 223.

Genoholotype.—Opertorbitolites douvillei Nuttall.

Test circular, lenticular, consisting of a median chamber-layer resembling that of *Orbitolites* with a thick imperforate lamina of shelly material on each side of the median layer.

Eocene. India.

Genus CRATERITES Heron-Allen and Earland, 1924

Craterites HERON-ALLEN and EARLAND, Journ. Linn. Soc. Zool., vol. 35, 35, 1924, p. 611.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 223.

Genoholotype.—Craterites rectus Heron-Allen and Earland.

Test probably attached in life, the whole composed of numerous layers of chambers, the basal layer without trace of spiral development, form in side view contracted above the base, and the outer end broadening and convex; chambers very numerous; wall calcareous; outer surface with numerous small rounded openings.

Recent. South Pacific.

Family 27. ALVEOLINELLIDAE

Test imperforate except the proloculum and second chamber; general shape of the test fusiform, coiled about an elongate axis; chambers completely involute, divided into chamberlets; apertures numerous, in one or more rows on the face of the last-formed chamber.

The foraminifera belonging to this family are highly developed, and have probably been derived from such forms as *Peneroplis* by the division of the close-coiled forms into chamberlets and an elongation of the axis. Some of the Eocene species of *Borelis* are much compressed in the line of the axis and for the exception of the division into chamberlets are close to *Peneroplis*. The greatest development of the family seems to have been in the Eocene when they were widely distributed in both the Eastern and Western Hemispheres. With the exception of a single small species of *Borelis*, the distribution of the family in the present oceans is mostly confined to the Indo-Pacific where large specimens are often very abundant in shallow warm water of coral reef regions.

Genus FLOSCULINA Stache, 1880

Flosculina Stache, Verhandl. k. k. Geol. Reichs., 1880, p. 199.—Cushman Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 226.
Alveolina (part) of Authors.

Genotype, by designation.—*Alveolina subpyrenaica*, var. *globosa* Leymerie.

Test globular or fusiform, planispiral; chambers completely involute, divided into chamberlets, the early coils high and of few chambers, later ones low and many chambered; wall imperforate except in the very earliest chambers which are finely perforate; apertures numerous, in a single row on the long apertural face.

Eocene.

Genus FLOSCULINELLA Schubert, 1910

Flosculinella Schubert, Neues Jahrb., Beilage-Band 29, 1910, p. 533.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 226.
Alveolina (part) of Authors.
Flosculina (part) of Authors.

Genotype, by designation.—*Flosculina bontangensis* Rutten.

Test differing from *Flosculina* in having more than one row of chambers in the last-formed whorls; the outer added chambers smaller than those proximal to them.

Oligocene and Miocene.

Genus BORELIS Montfort, 1808

Borelis Montfort, Conch. Syst., vol. 1, 1808, p. 171.—Cushman, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 226.
Clausulus Montfort, Conch. Syst., vol. 1, 1808, p. 179 (genoholotype, *Clausulus indicata* Montfort=*Nautilus melo* Fichtel and Moll (part)).
Melonites Lamarck, Extrait Cours. Zool., 1812, p. 122 (genotype, by designation, *Melonites sphaerica* Lamarck).
Oryzaria Defrance, Dict. Sci. Nat., vol. 16, 1820, p. 106 (genoholotype, *Oryzaria boscii* Defrance).
Melonia Defrance, Dict. Sci. Nat., vol. 32, 1824, p. 176 (genotype, by designation, *Melonites sphaerica* Lamarck).
Alveolina d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 306 (genotype, by designation, *Oryzaria boscii* Defrance).

Genoholotype.—*Borelis melonoides* Montfort = *Nautilus melo* Fitchel and Moll (part).

Test globular or fusiform, coiled planispirally about an axis, early coils as well as later ones low; chambers divided into chamberlets; apertures usually in a single row.

Eocene to Recent.

The single species from the West Indian region is all that is recorded from this part of the Atlantic. Brady gives records from the Cape Verde Islands, but I have not seen the material.

BORELIS PULCHRA (d'Orbigny)

Plate 15, figures 9, 10

Alveolina pulchra D'ORBIGNY, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères." p. 70, pl. 8, figs. 19, 20.—CUSHMAN, Proc. U. S. Nat. Mus., vol. 59, 1919, p. 77, pl. 19, figs. 7–9; Publ. 311, Carnegie Instit. Washington, 1922, p. 82.

Alveolina melo (part) (not Fichtel and Moll), H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 223, pl. 17, figs. 14, 15.—WOODWARD, The Observer, vol. 4, 1893, p. 78.

Test small, completely involute, globular or slightly fusiform; chambers distinct, usually four in a coil, divided into elongate chamberlets but the chamberlets not again subdivided, growing edge low and connecting the two umbilici; wall imperforate, milky-white; apertures consisting of a single row of rounded pores, one to each chamberlet, in the apertural face.

Diameter, 0.45 mm.

This species is rare in the West Indian region. Brady gives the West Indies, Bermuda, and Cape Verde Islands for Atlantic localities. D'Orbigny's types are from Cuba. I have collected it on the north coast of Jamaica, at a few stations in the Tortugas region, and at Bermuda.

So far as I have seen, material from the Indo-Pacific, the material to be referred to *Borelis melo* (Fichtel and Moll), is definitely larger and usually has more chambers in the coil.

Borelis pulchra—Material examined

Cat. No.	Collection of—	Number of specimens	Station (Albatross)	Locality	Depth in fathoms	Bottom temperature	Character of bottom	Abundance
20862	U.S.N.M.	1	D2758	6° 59′ 30″ S.; 37° 47′ 00″ W.	20	79	brk. sh.	Rare.
10321	J.A.C.	1		Runaway Bay, Jamaica, West Indies.				Do.
6188	J.A.C.	2		Habana Harbor, Cuba				Do.
9961	J.A.C.	3		do				Do.
4981	J.A.C.	1	26	Dry Tortugas, Fla.	2			Do.
4982	J.A.C.	2		Nassau Harbor, Bahamas				Do.
4979	J.A.C.	1	6	Dry Tortugas, Fla.	⅔		m.	Do.
4980	J.A.C.	5	30	do	2		s.	Few.
4983	J.A.C.	2		Runaway Bay, Jamaica, West Indies.				

Genus ALVEOLINELLA H. Douvillé, 1906

Alveolinella H. DOUVILLÉ, Bull. Soc. Géol. France, ser. 4, vol. 6, 1906, p. 585.—CUSHMAN, Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, p. 227.

Alveolina (part) D'ORBIGNY, 1826.

Genoholotype.—Alveolina quoyi d'Orbigny.

Test fusiform, planispirally coiled about an axis, all coils low; apertures very numerous, in several rows.

Recent.

PLATES

EXPLANATION OF PLATES

Plate 1

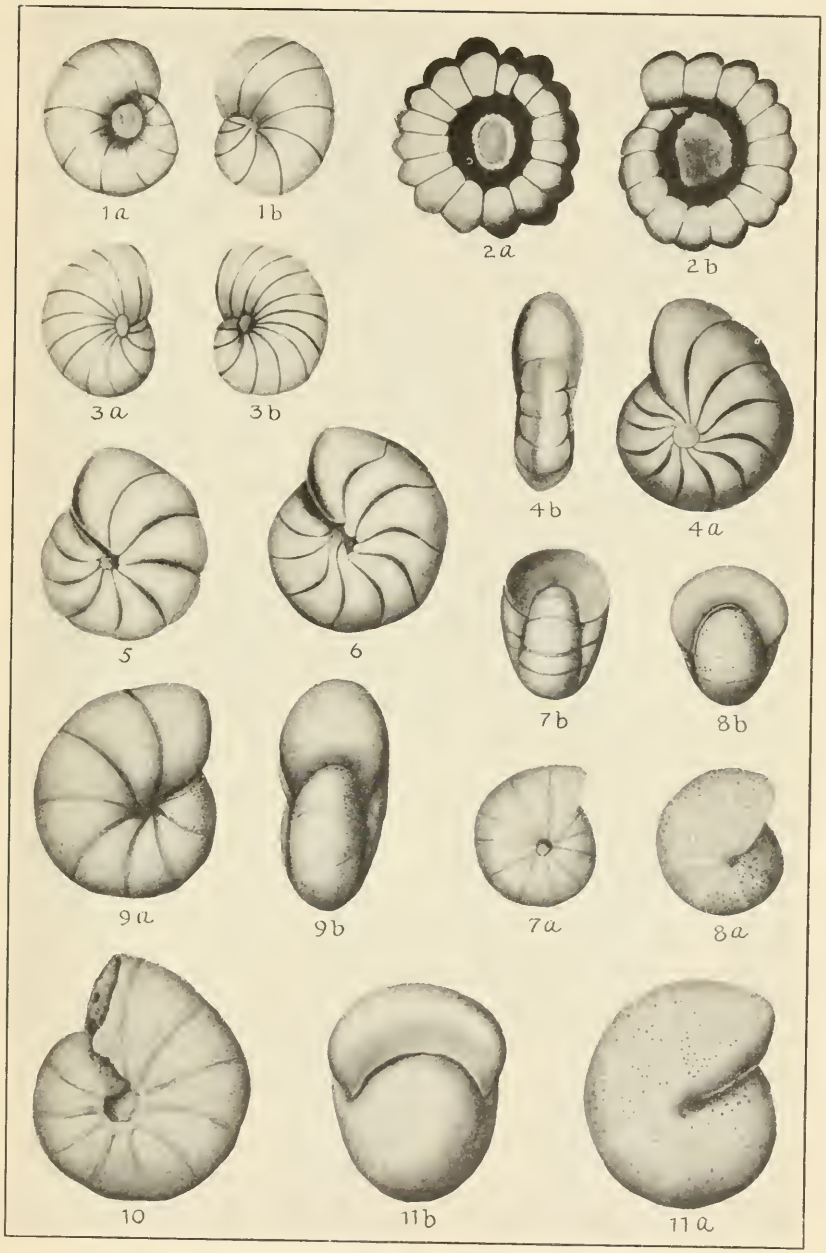
Figures 1 *a*, *b*. *Nonion* (*?*) *umbilicatulum* (Walker and Jacob). (After Walker and Jacob.)

2 *a*, *b*. *Nonion* (*?*) *crassulum* (Walker and Jacob). (After Walker and Jacob.)

3 *a*, *b*. *Nonion depressulum* (Walker and Jacob). (After Walker and Jacob.)

4–6. *Nonion depressulum* (Walker and Jacob). (After Heron-Allen and Earland.) × 90. West of Scotland.

7–11. *Nonion pompilioides* (Fichtel and Moll). Figs. 7*a*, *b*. (After Fichtel and Moll.) Figs. 8*a*, *b*. (After H. B. Brady.) × 60. West of Ireland. Figs. 9*a*, *b*. Off Ragged Key, Fla. 80 fathoms. × 100. Fig. 10. Off Ireland. × 80. Fig. 11. East coast of United States. × 80.



NONIONIDAE OF THE ATLANTIC OCEAN

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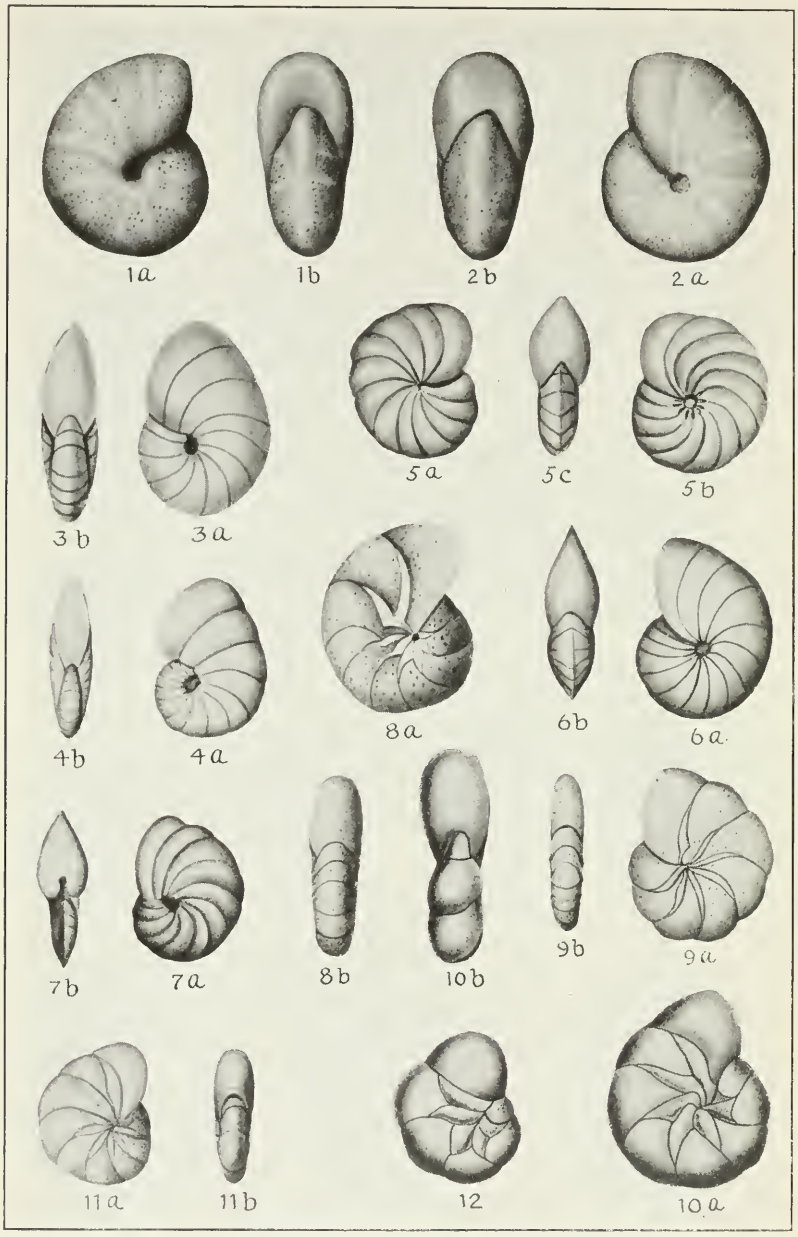

NONIONIDAE OF THE ATLANTIC OCEAN

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Plate 2

Figures 1, 2. *Nonion pompilioides* (Fichtel and Moll). × 80. Off northeastern coast of United States. *a*, *a*, side views; *b*, *b*, apertural views.

3, 4. *Nonion scaphum* (Fichtel and Moll). Fig. 3. (After Fichtel and Moll.) Fig. 4. (After H. B. Brady.)

5–7. *Nonion asterizans* (Fichtel and Moll). Fig. 5. (After Fichtel and Moll.) Fig. 6. (After Goës.) Fig. 7, "*Nonionina boueana* d'Orbigny." (After d'Orbigny.)

8–12. *Nonion stelligerum* (d'Orbigny). Fig. 8. (After d'Orbigny.) Canary Islands. Fig. 9. (After H. B. Brady.) Shetlands. Figs. 10, 12. (After Heron-Allen and Earland.) Off west of Scotland. Fig. 11. (After H. B. Brady.) East of Shetlands.

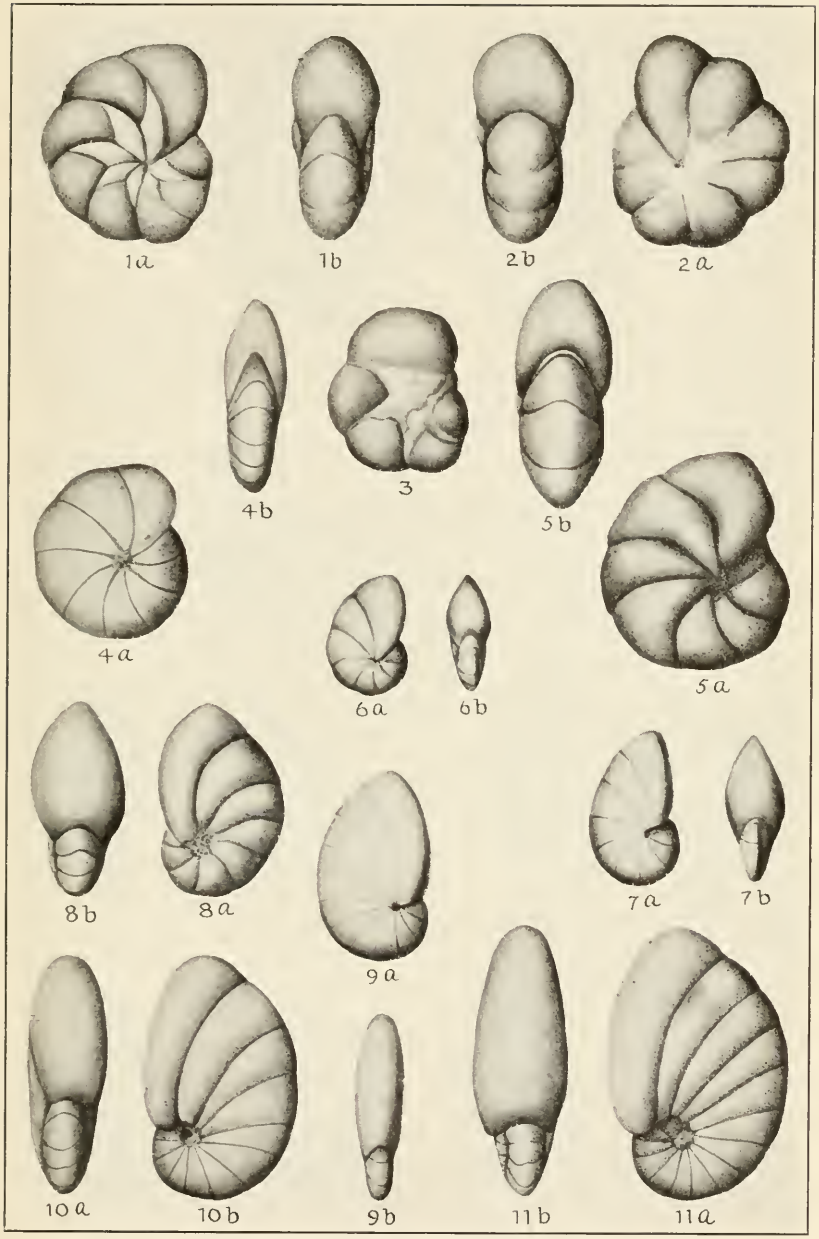
Plate 3

Figures 1–3. *Nonion stelligerum* (d'Orbigny), Fig. 1, off Iceland. × 80. Fig. 2, Hudson Bay. × 80. Fig. 3, off Fowey Light, Florida. × 100.

4, 5. *Nonion germanicum* (Ehrenberg). Fig. 4. (After Williamson), Great Britain. Fig. 5, Bognor, Sussex, England. × 100.

6–8. *Nonion sloanii* (d'Orbigny). Fig. 6. (After d'Orbigny), "*N. brownii* d'Orbigny." Fig. 7. (After d'Orbigny.) Fig. 8, San Juan Harbor, Porto Rico. × 100.

9–11. *Nonion grateloupi* (d'Orbigny). Fig. 9. (After d'Orbigny.) Fig. 10, Montego Bay, Jamaica. × 80. Fig. 11, Tortugas, Fla. × 80.



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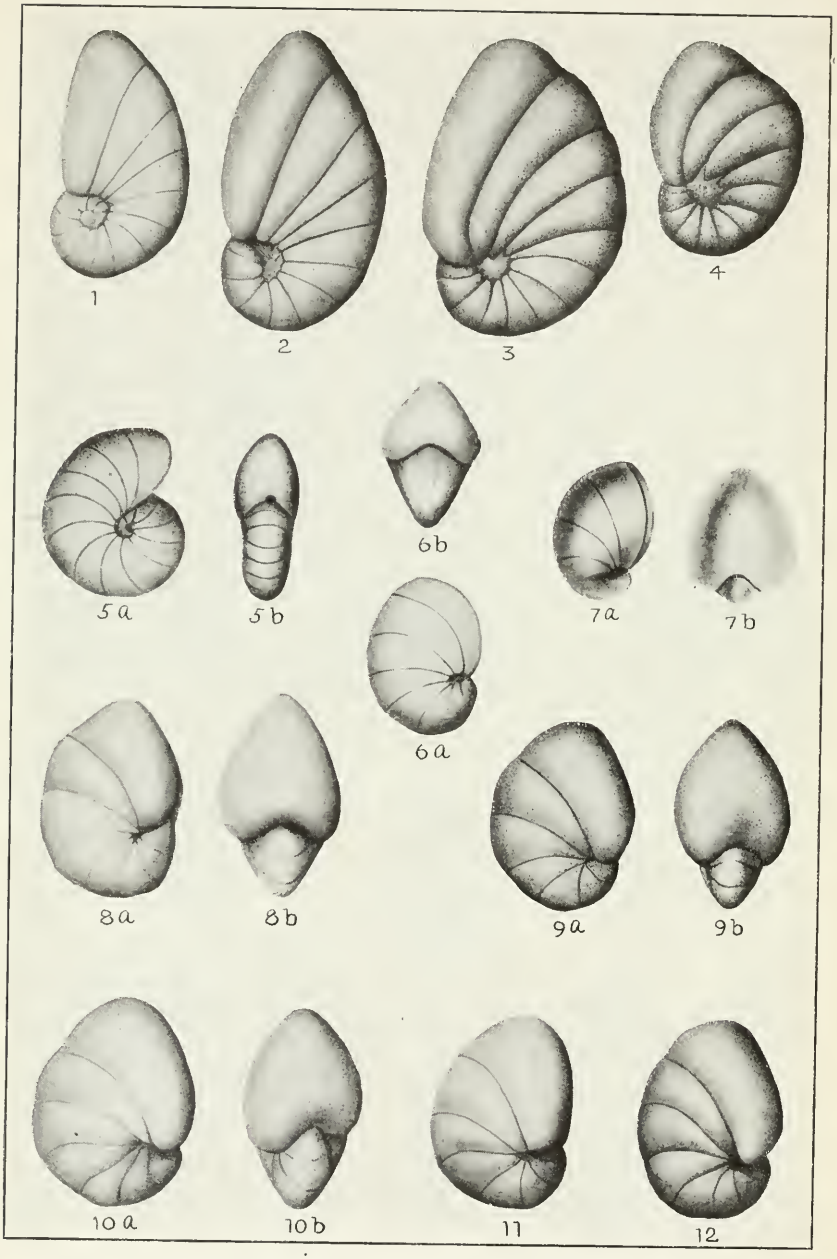

NONIONIDAE OF THE ATLANTIC OCEAN

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Plate 4

Figures 1–4. *Nonion grateloupi* (d'Orbigny). Specimens from Tortugas, Fla., showing variation in shape in side view. × 100.

5. *Nonion barleeanum* (Williamson). (After Williamson.)

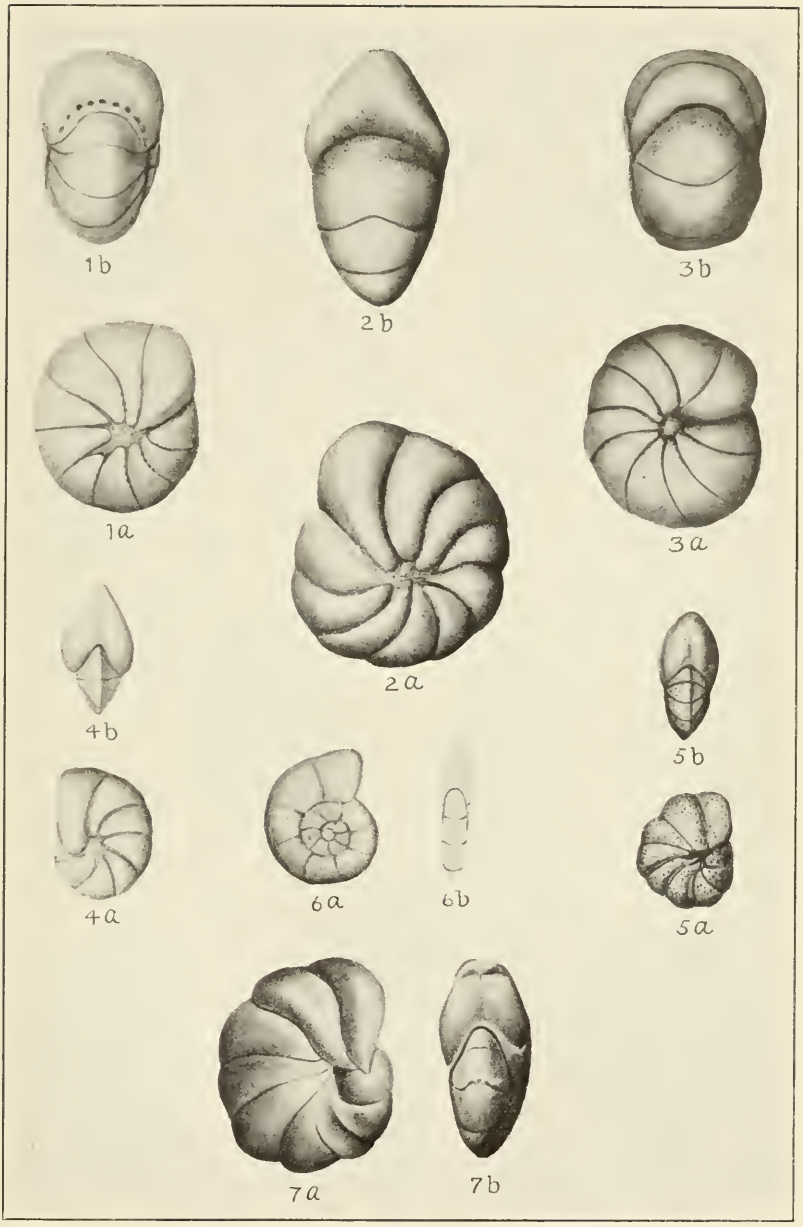
6–12. *Nonion labradoricum* (Dawson). Fig. 6. (After Morton.) Fig. 7. (After Dawson.) Fig. 8, Gaspé Bay. × 60. Figs. 9, 10, Casco Bay, Me. × 60. Figs. 11, 12, *Albatross* D 2202, Northeastern coast of United States. × 60.

PLATE 5

FIGURES 1–3. *Nonion orbiculare* (H. B. Brady). Fig. 1. (After H. B. Brady.) Fig. 2. Hudson Bay. × 60. Fig. 3. (After H. B. Brady.) Faroë Channel.

4, 5, 7. *Nonion pauperatum* (Balkwill and Wright). Fig. 4. (After Balkwill and Wright.) Fig. 5. (After Halkyard), off Island of Jersey. Fig. 7. (After Heron-Allen and Earland.) Off south coast of England at Selsey.

6. *Nonion (?) exponens* (H. B. Brady, Parker, and Jones). (After type figure.) Abrohlos Bank.



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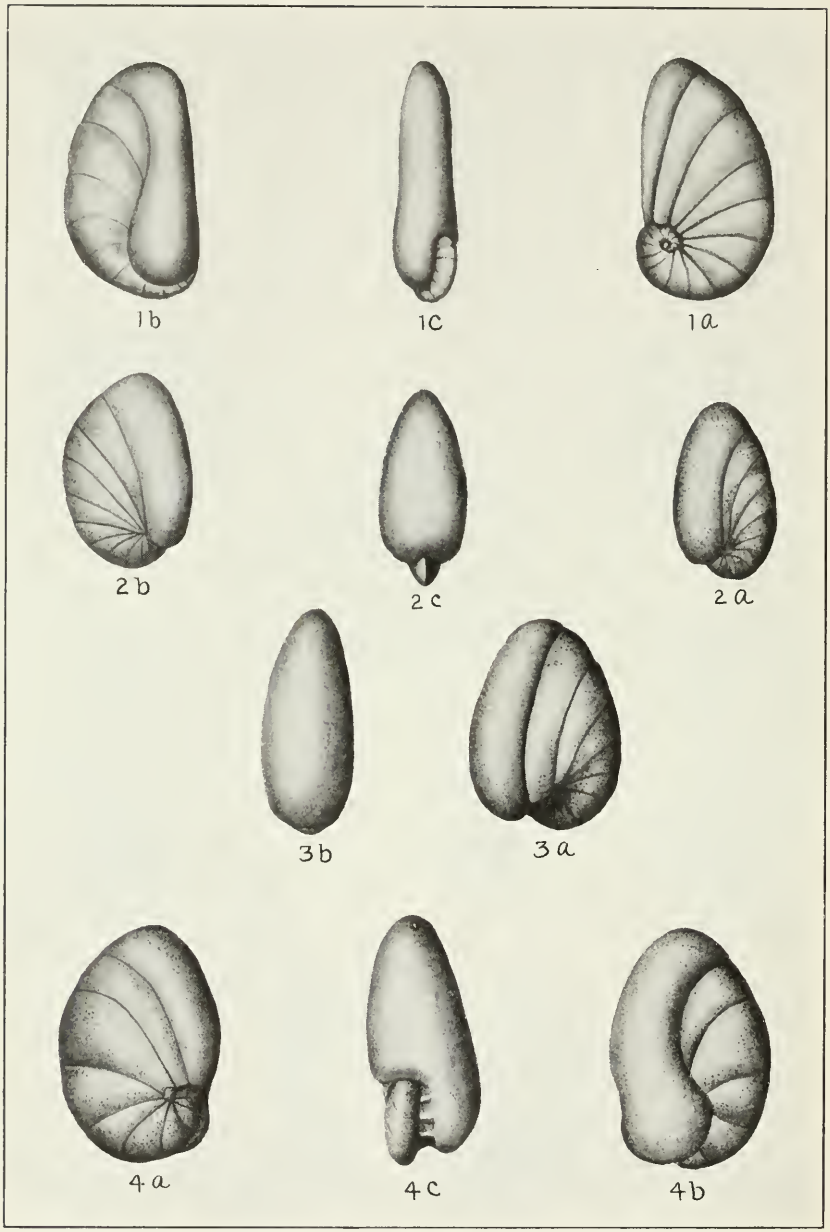

NONIONIDAE OF THE ATLANTIC OCEAN

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PLATE 6

Nonionella turgida (Williamson)

FIGURES 1, 2. (After Williamson), *a*, dorsal view; *b*, apertural view; *c*, peripheral view.

3, 4. Off S. W. Ireland. × 100.

Plate 7

Figures 1. *Elphidium alvarezianum* (d'Orbigny). (After d'Orbigny's type figure.) *a*, side view; *b*, apertural view.

2, 3. *Elphidium alvarezianum* (d'Orbigny). × 60. From photographs of specimens from off Falkland Islands.

4. *Elphidium incertum* (Williamson). (After Williamson.) *a*, side view; *b*, apertural view.

5. *Elphidium incertum* (Williamson). × 60. (After H. B. Brady.) From *Challenger* Station 46, North Atlantic.

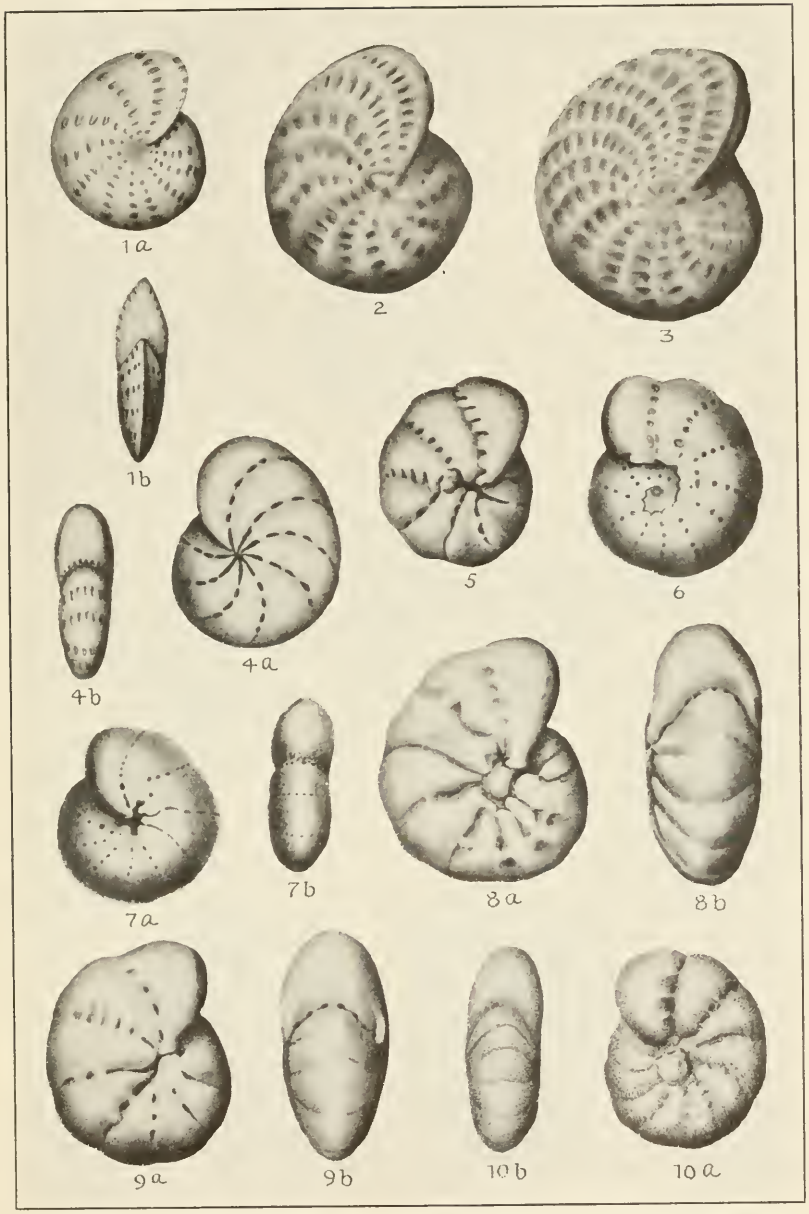
6. *Elphidium incertum* (Williamson). × 50. (After Heron-Allen and Earland.) From off west coast of Scotland.

7. *Elphidium incertum* (Williamson). × 50. (After Heron-Allen and Earland.) From off west coast of Scotland.

8. *Elphidium incertum* (Williamson). × 80. From off Bates Island, Casco Bay, Me. *a*, side view; *b*, apertural view.

9. *Elphidium incertum* (Williamson). × 80. From Hudson Bay. *a*, side view; *b*, apertural view.

10. *Elphidium incertum* (Williamson), var. *clavatum* Cushman, new variety. × 60. From Spar Landing, Frenchmans Bay, Me. *a*, side view; *b*, apertural view.



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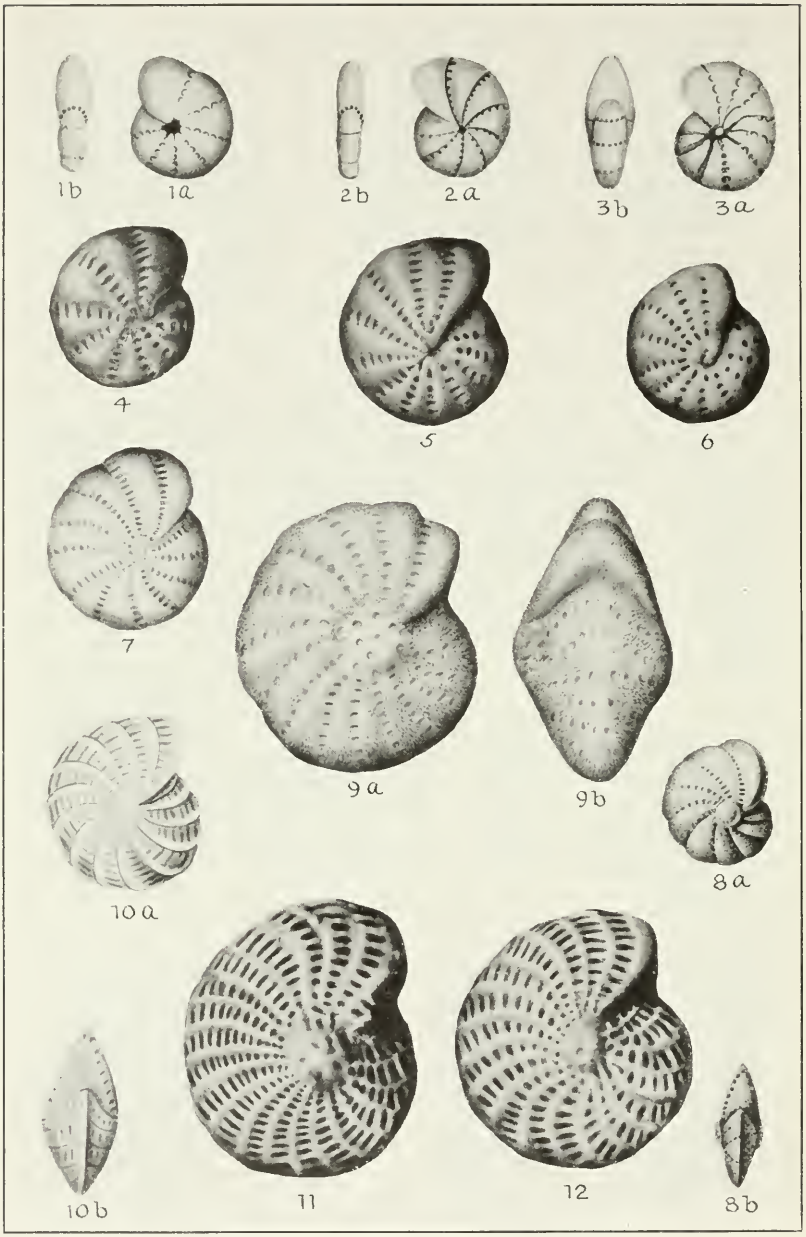

NONIONIDAE OF THE ATLANTIC OCEAN

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Plate 8

Figures 1–3. *Elphidium excavatum* (Terquem). × 40. (After Terquem.) From coast of France. *a*, side views; *b*, apertural views.

4–6. *Elphidium excavatum* (Terquem). × 60. From Bognor, England.

7. *Elphidium excavatum* (Terquem). (After Williamson.)

8. *Elphidium discoidale* (d'Orbigny). (After type figure.) *a*, side view; *b*, apertural view.

9. *Elphidium discoidale* (d'Orbigny). × 60. From Tortugas, Fla. *a*, side view; *b*, apertural view.

10. *Elphidium owenianum* (d'Orbigny). (After type figure.) *a*, side view; *b*, apertural view.

11, 12. *Elphidium owenianum* (d'Orbigny). × 60. From Falkland Islands.

Plate 9

Figures 1. *Elphidium lessonii* (d'Orbigny). (After type figure.) *a*, side view; *b*, apertural view.

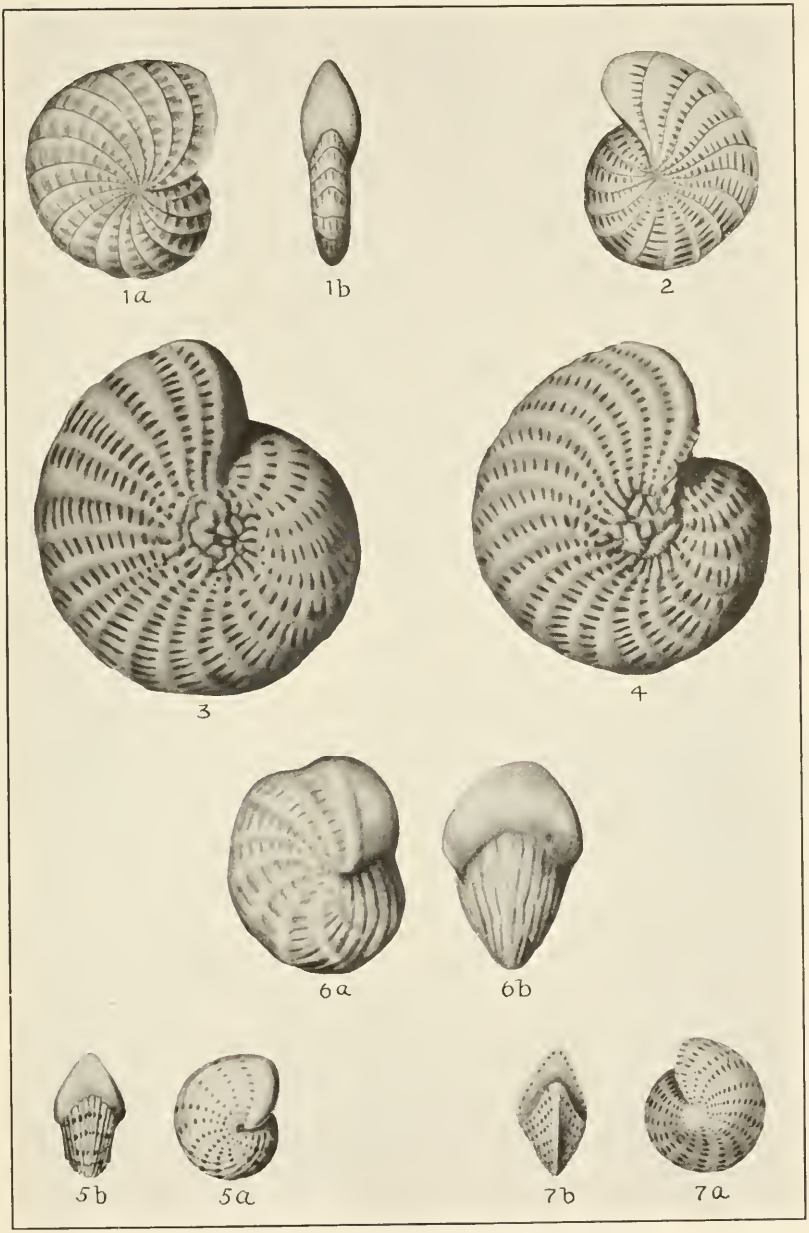
2. *Elphidium lessonii* (d'Orbigny). × 40. (After H. B. Brady.) From *Challenger* Station 315A, Falkland Islands.

3, 4. *Elphidium lessonii* (d'Orbigny). × 60. From Falkland Islands.

5. *Elphidium sagrum* (d'Orbigny). (After type figure.) *a*, side view; *b*, apertural view.

6. *Elphidium sagrum* (d'Orbigny). × 60. From Porto Rico. *a*, side view; *b*, apertural view.

7. *Elphidium lanieri* (d'Orbigny). (After type figure.) *a*, side view; *b*, apertural view.



NONIONIDAE OF THE ATLANTIC OCEAN

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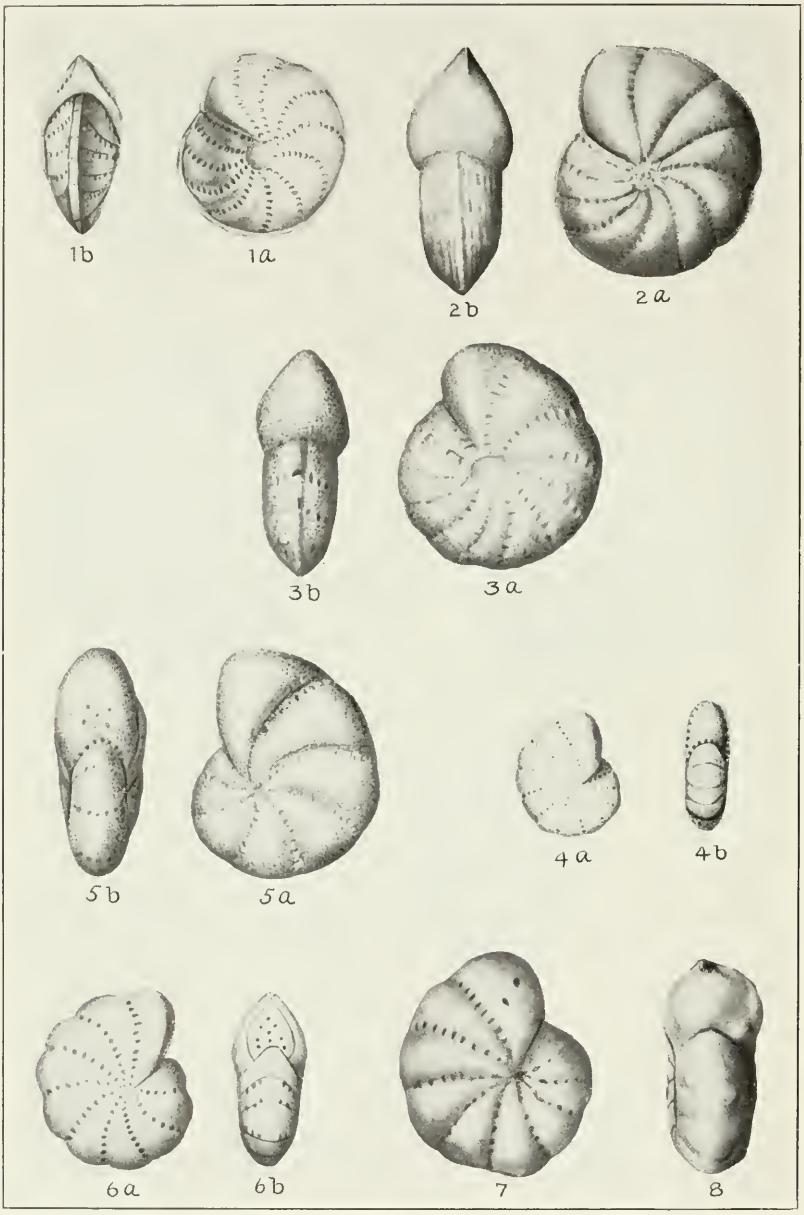

NONIONIDAE OF THE ATLANTIC OCEAN

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PLATE 10

FIGURES 1. *Elphidium advenum* (Cushman). × 60. (After H. B. Brady.) *a*, side view; *b*, apertural view.

2. *Elphidium advenum* (Cushman). × 80. From Tortugas, Fla. *a*, side view; *b*, apertural view.

3. *Elphidium advenum* (Cushman), var. *margaritaceum* (Cushman), new variety. × 80. From beach, Newport, R. I. *a*, side view; *b*, apertural view.

4. *Elphidium poeyanum* (d'Orbigny). (After type figure.) *a*, side view; *b*, apertural view.

5. *Elphidium poeyanum* (d'Orbigny). × 80. From Montego Bay, Jamaica. *a*, side view; *b*, apertural view.

6. *Elphidium articulatum* (d'Orbigny). (After type figure.) *a*, side view; *b*, apertural view.

7, 8. *Elphidium articulatum* (d'Orbigny). × 60. From Falkland Islands.

PLATE 11

FIGURES 1. *Elphidium arcticum* (Parker and Jones). × 60. (After Balkwill and Wright.) Off Kish Bank, Ireland. *a*, side view; *b*, apertural view.

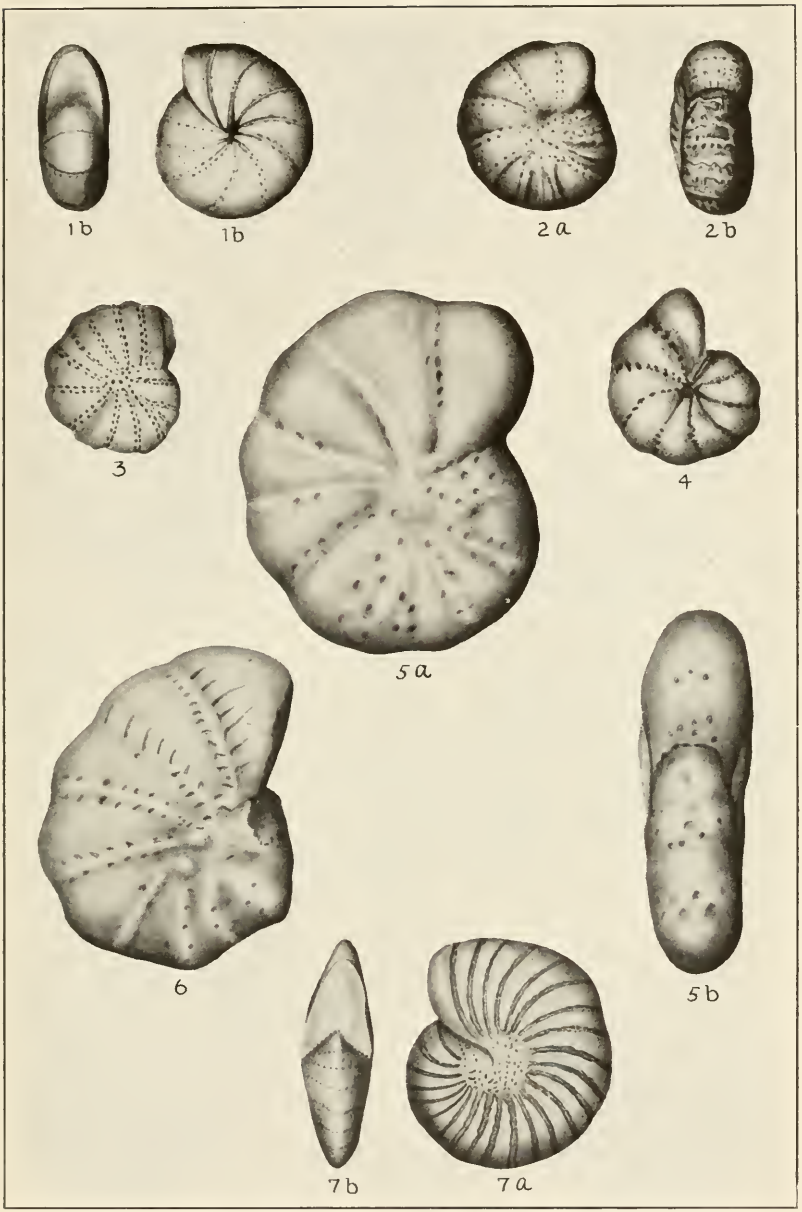
2. *Elphidium arcticum* (Parker and Jones). × 25. (After H. B. Brady.) Arctic. *a*, side view; *b*, apertural view.

3. *Elphidium arcticum* (Parker and Jones). (After Dawson.) Gaspé Bay.

4. *Elphidium arcticum* (Parker and Jones). (After H. B. Brady.) Arctic.

5, 6. *Elphidium arcticum* (Parker and Jones). × 50. From Gaspé Bay. *a*, side view; *b*, apertural view.

7. *Elphidium sibiricum* (Goës). (After type figure.) Arctic. *a*, side view; *b*, apertural view.



NONIONIDAE OF THE ATLANTIC OCEAN

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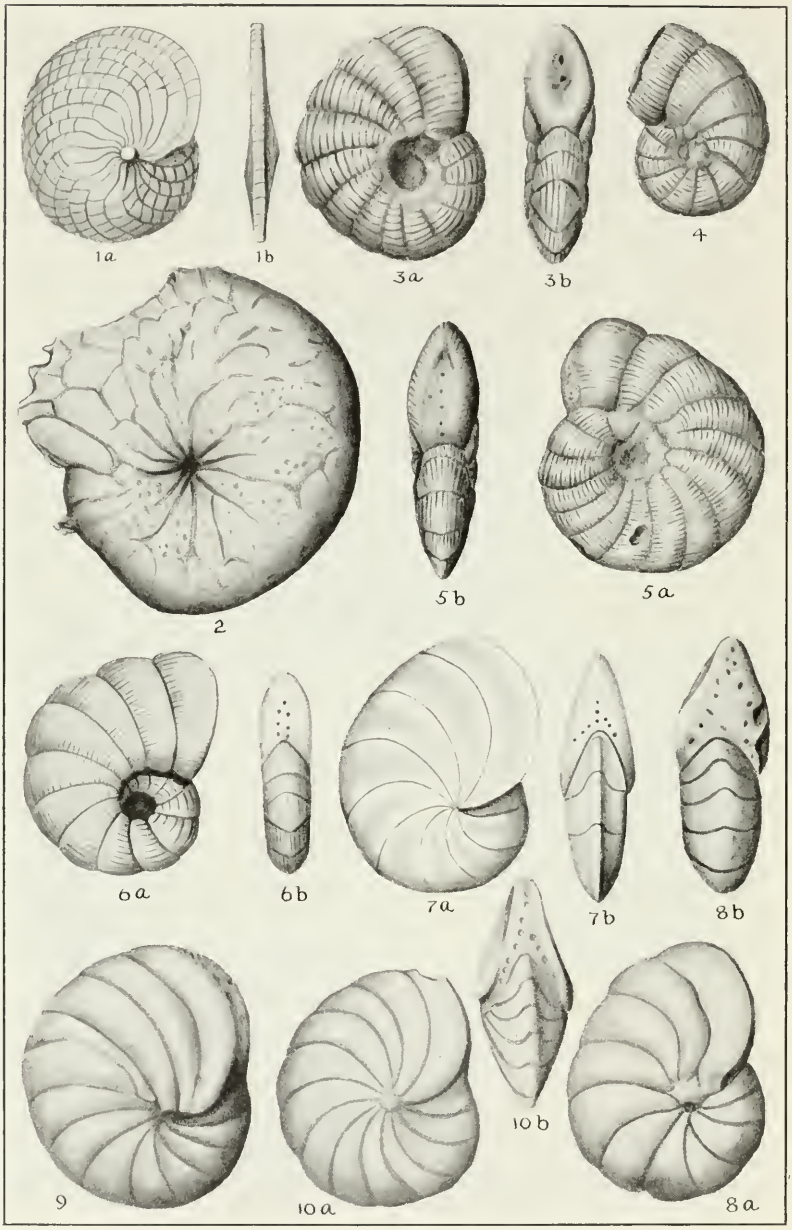

CAMERINIDAE AND PENEROPLIDAE OF THE ATLANTIC OCEAN

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Plate 12

Figures 1. *Heterostegina antillarum* d'Orbigny. (After type figure.)

2. *Heterostegina antillarum* d'Orbigny. × 25. Tortugas, Fla. Young stage.

3–6. *Peneroplis pertusus* (Forskål). Fig. 3 *a*, *b*, Tortugas, Fla. × 60. *a*, side view; *b*, apertural view. Fig. 4, Porto Rico. × 60. Fig. 5, *a*, *b*, Off Morro Castle, Havana Harbor, Cuba. × 60. *a*, side view; *b*, apertural view. Fig. 6 *a*, *b*, "*Peneroplis elegans* d'Orbigny." (After d'Orbigny.) *a*, side view; *b*, apertural view.

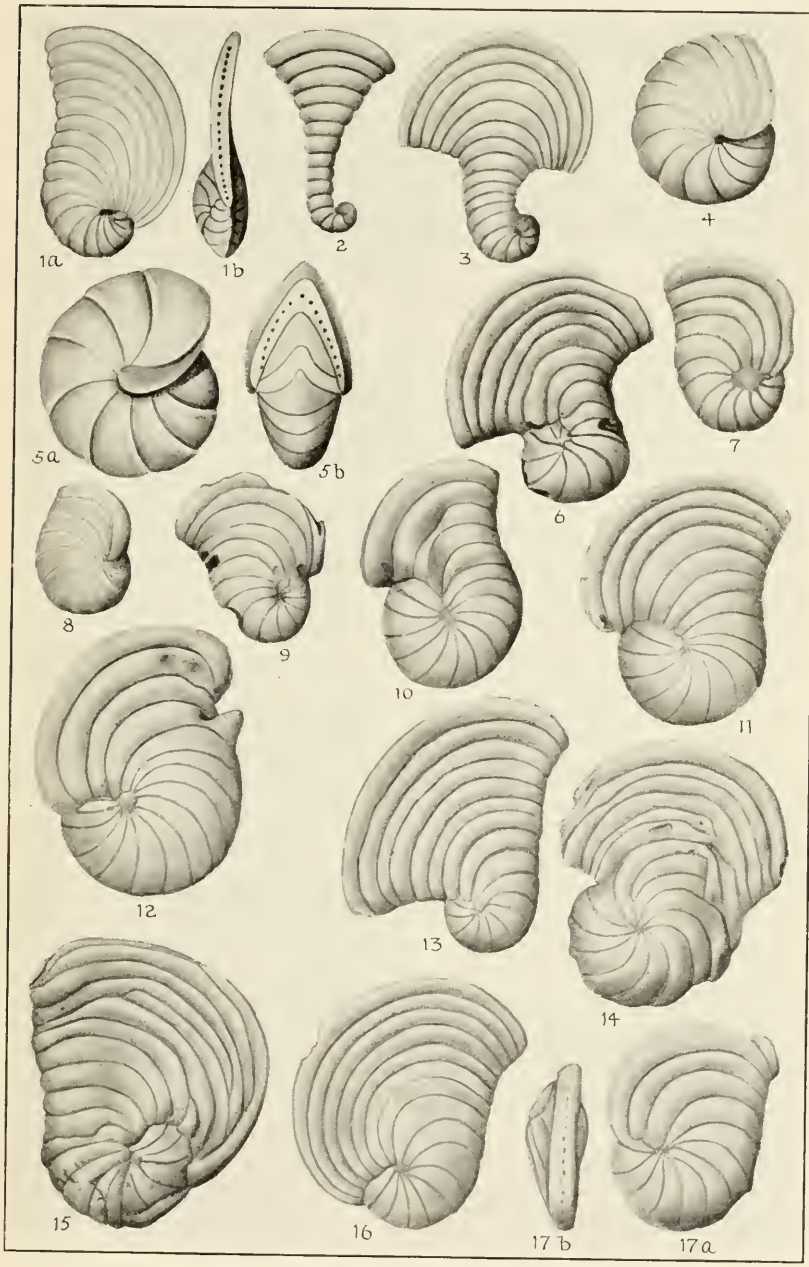
7–10. *Peneroplis carinatus* d'Orbigny. Fig. 7 *a*, b. (After type figure.) *a*, side view; *b*, apertural view. Fig. 8 *a*, *b*, Havana Harbor, Cuba. × 60. *a*, side view; *b*, apertural view. Fig. 9, Tortugas, Fla. × 60. Fig. 10 *a*, b, Montego Bay, Jamaica. × 60. *a*, side view; *b*, apertural view.

Plate 13

All specimens *Peneroplis proteus* d'Orbigny

Figures 1–5. (After d'Orbigny.) *a*, side view; *b*, apertural view. Fig. 5, "*Peneroplis dubius* d'Orbigny."

6–17. × 45. Figs. 6, 7, 10, 15–17, Bermuda. Figs. 8, 9, San Juan Harbor, Porto Rico. Fig. 11, Havana Harbor, Cuba. Fig. 12, Montego Bay, Jamaica. Fig. 13, Tortugas, Fla. Fig. 14, Nassau Harbor, Bahamas.



PENEROPLIDAE OF THE ATLANTIC OCEAN

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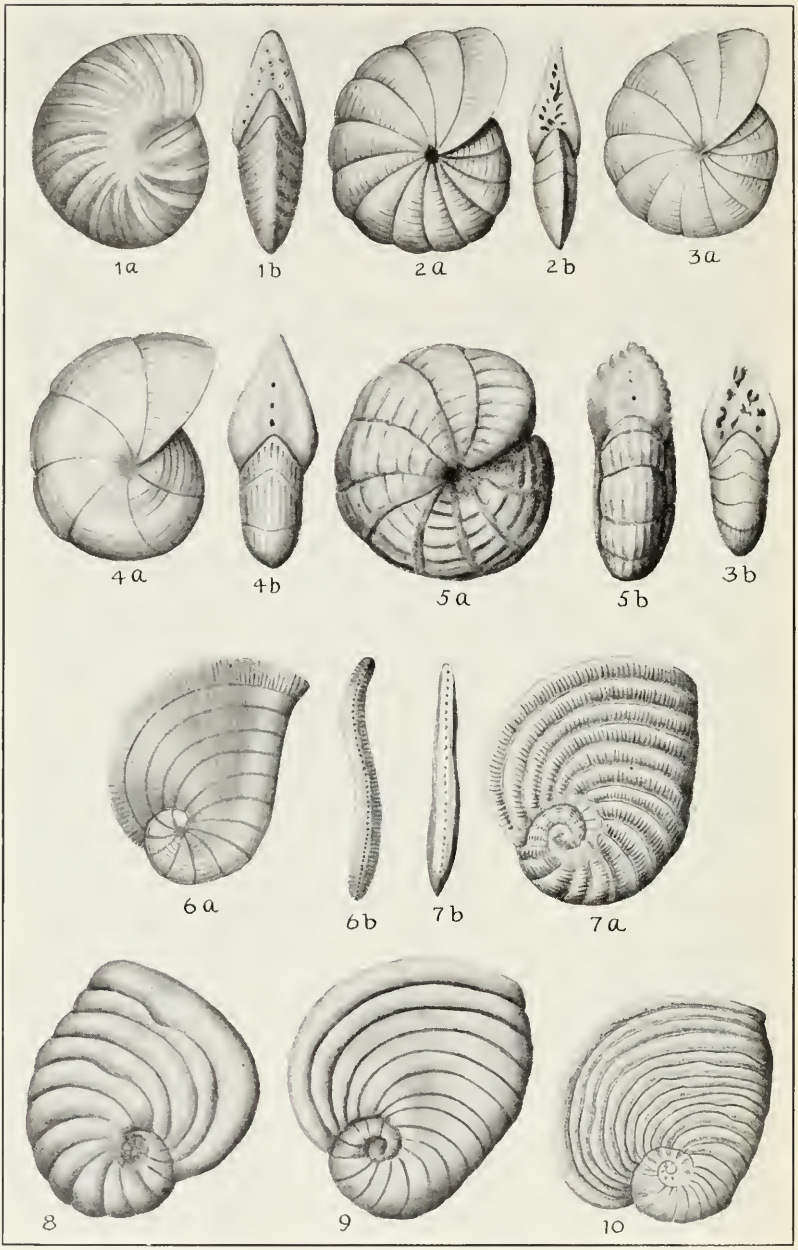

PENEROPLIDAE OF THE ATLANTIC OCEAN

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Plate 14

Figures 1. *Peneroplis carinatus* d'Orbigny. Cape Verde Islands. (After H. B. Brady.) × 40.

2–5. *Dendritina antillarum* (d'Orbigny). Figs. 2, 3. (After d'Orbigny.) Fig. 4, "*Peneroplis pulchellus* d'Orbigny." (After d'Orbigny.) Fig. 5, Young specimen. Bermuda. × 80. *a*, side view; *b*, apertural view.

6, 7. *Peneroplis planatus* (Fichtel and Moll). Fig. 6. (After Fichtel and Moll). Fig. 7, (after H. B. Brady). × 40.

8–10. *Peneroplis bradyi* Cushman, new species. Fig. 8, Tortugas, Fla. × 80. Fig. 9, Holotype, Montego Bay, Jamaica. × 80. Fig. 10. (After H. B. Brady.) × 40.

Plate 15

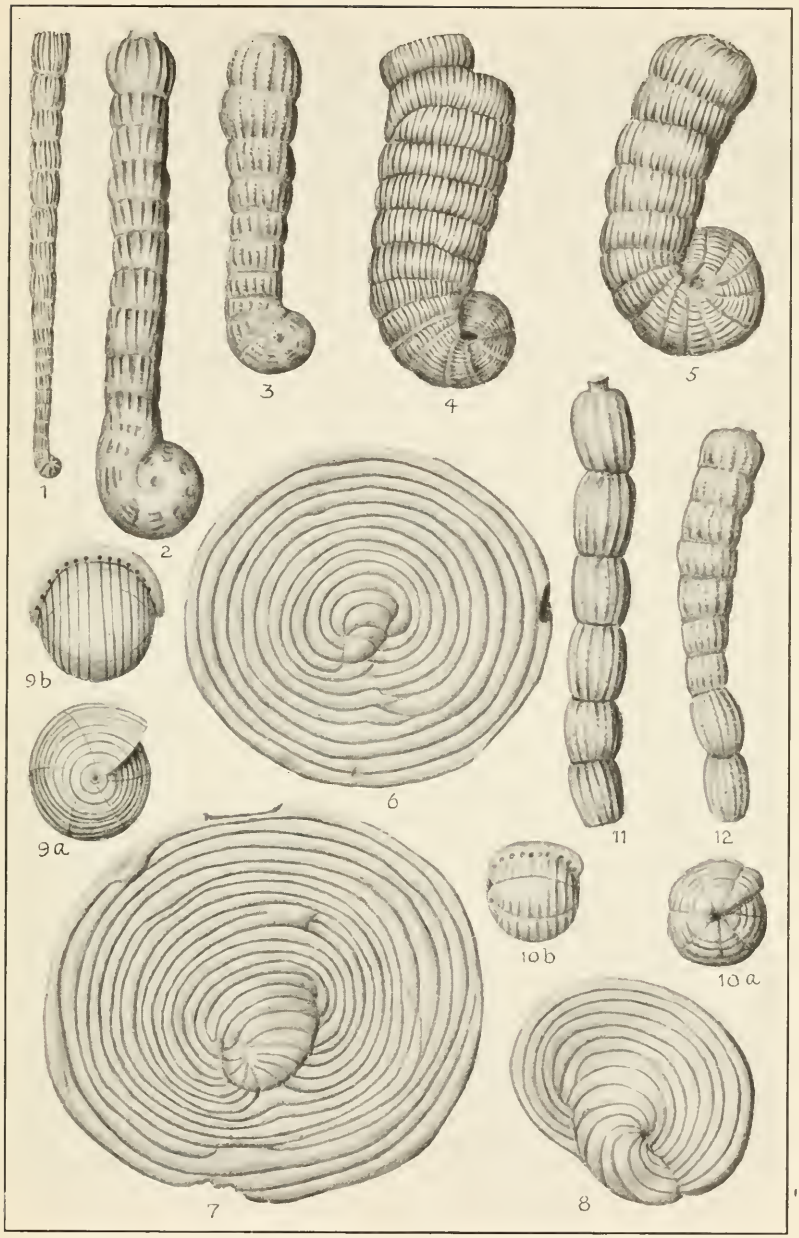
Figures 1–3. *Spirolina acicularis* (Batsch). Fig. 1. (After Batsch.) Figs. 2, 3, Tortugas, Fla. × 100.

4, 5. *Spirolina arietinus* (Batsch). Fig. 4. (After Batsch.) Fig 5, Tortugas, Fla. × 60.

6–8. *Peneroplis discoideus* Flint. Fig. 6, Montego Bay, Jamaica. × 25. Fig. 7, Bermuda. × 25. Fig. 8, Tortugas, Fla. × 25.

9, 10. *Borelis pulchra* (d'Orbigny). Fig. 9 *a*, *b*. (After d'Orbigny.) *a*, side view; *b*, apertural view. Fig. 10 *a*, *b*, Nassau Harbor, Bahamas. × 30. *a*, side view; *b*, apertural view.

11, 12. *Monalysidium politum* Chapman (?). × 100. Tortugas, Fla.



PENEROPLIDAE AND ALVEOLINELLIDAE OF THE ATLANTIC OCEAN

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PENEROPLIDAE OF THE ATLANTIC OCEAN

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PLATE 16

From photographs

FIGURES 1–3. *Archaias angulatus* (Fichtel and Moll). Figs. 1, 2 San Jaun Harbor, Porto Rico. × 20. Fig. 3, Tortugas, Fla. × 15

Plate 17

From photographs

Figures 1, 2. *Archaias compressus* (d'Orbigny). Ely's Harbor, Somerset, Bermuda. × 20.

3–5. *Archaias angulatus* (Fichtel and Moll). Figs. 3, 4, San Juan Harbor, Porto Rico. × 20. Fig. 5, Tortugas, Fla. × 15.

PENEROPLIDAE OF THE ATLANTIC OCEAN

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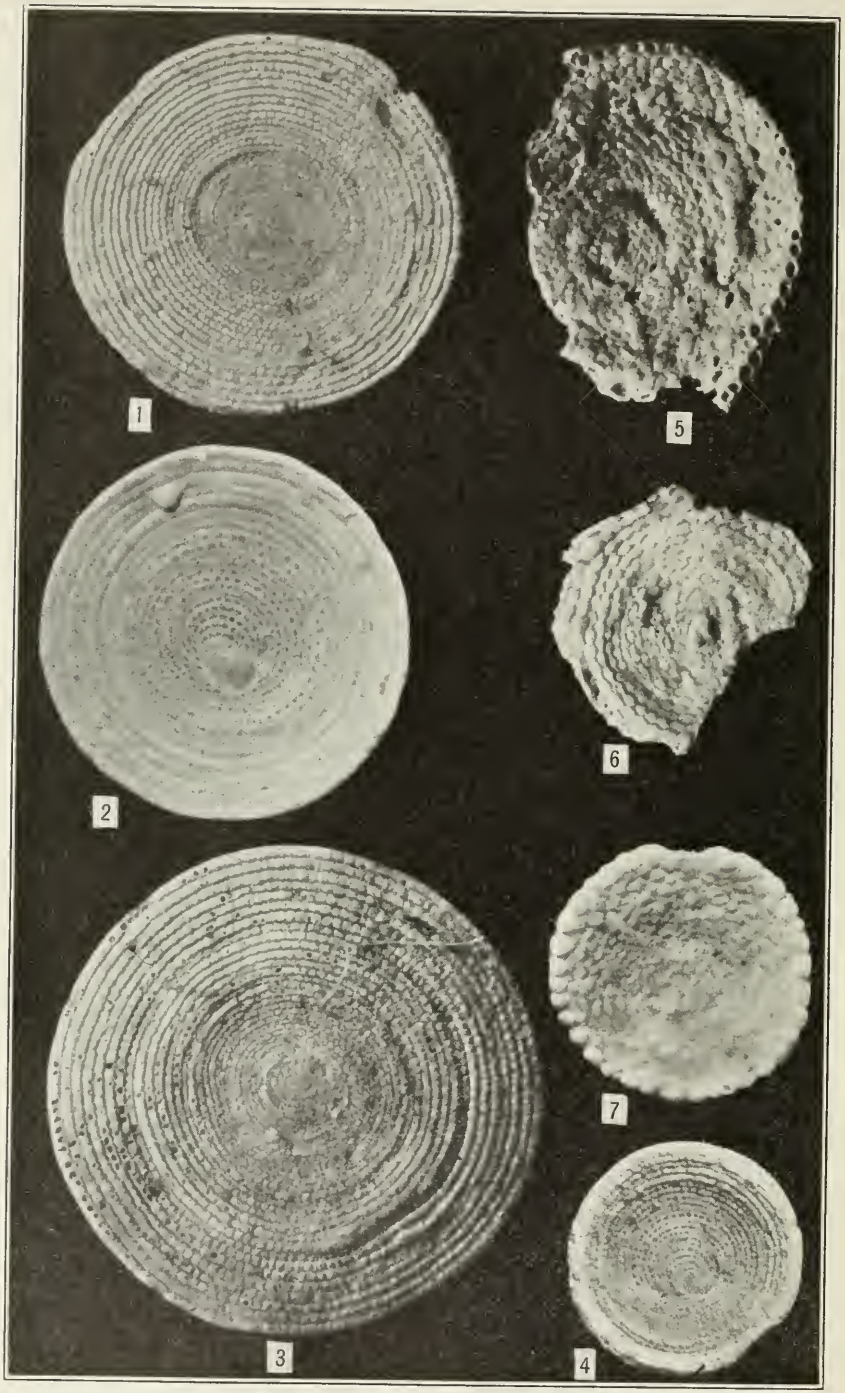

PENEROPLIDAE OF THE ATLANTIC OCEAN

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Plate 18

From photographs

Figures 1–4. *Sorites marginalis* (Lamarck). From Tortugas, Fla. × 20.
5–7. *Amphisorus hemprichii* Ehrenberg. × 20. Figs. 5, 6, Tortugas, Fla. Fig. 7, Ely's Harbor, Somerset, Bermuda.

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